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"The extraordinary insults and aggressions of the Imperial German Government left us no self-respecting choice but to take up arms in defense of our rights as a free people and of our honor as a sovereign Government"

Woodrow Wilson

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The object of this journal is to record accurately and lucidly the latest scientific, mechanical and industrial news of the day. As a weekly journal, it is in a position to announce interesting developments before they are published elsewhere.

The Editor is glad to have submitted to him timely articles suitable for these columns, especially when such articles are accompanied by photographs.

A Freak Gun for a Foolish Purpose

LIKE any other bully, the Prussian believes that frightfulness is a most efficient weapon of attack. Against a coward it is—against a brave man, it is not. Rather, it serves to stiffen his moral fiber, and put a keener edge upon his resistance.

That is an outstanding lesson of the war, which seems, even at this late day, to have failed to penetrate the armor-plated citadel, within which reposes that curious phenomenon known as the German mind.

One of the principal objects of the system of education that the military masters of Germany have imposed upon the German people, is to get them to believe that they are not as other men; and in this they have certainly met with brilliant success. The belief in German superiority is fundamental; it is boisterously vocal; it is "shouted from the housetops."

The ancient Greeks had the same belief, and they used a term "The Barbarians" to designate all peoples who were not Greeks. And that wonderful race was so greatly superior in art, letters, laws, ethics of conduct, and many other things that are implied by the term civilization, that the distinction was fairly well justified.

But the very standards by which we endorse the Greek assumption of superiority, create in us only derisive laughter when we apply them to the Prussian of today. Had the Prussianism of Wilhelm, Hollweg, Bernstorff, Kluck, Hindenburg and Tirpitz been the controlling spirit of any race of people contemporary with the Greeks, we may be pretty sure that they would have been reckoned as among the barbarians—and very low down upon the list at that.

But what has all this got to do with the bombardment of Paris by a super-range gun? It has just this much to do with it: that the gun was conceived, built, and is now operating, because the Prussian, even at this late day, is possessed with the idea that he can frighten people into submission.

For it is a fact that this gun, which is receiving a great deal more advertising than it is honestly entitled to, is of practically no military value. The construction of a gun capable of throwing a projectile seventy miles and more, is of course on the face of it, an engineering feat of magnitude, proper credit for which we would be the last to withhold. The principles, long understood, which govern the building of such a weapon, are explained in an article on another page of this issue. But this gun was designed to be, and the Prussians believed it would prove to be an instrument of terror, a dramatic and awe-inspiring demonstration of the fact that the German arm is long, can reach far, and strike hard.

So the super-man set out to build a super-gun with which to strike super-terror into the hearts of his enemies. And everything has come through strictly according to plan and schedule—except the terror. However, the Prussian, judging from dispatches, has at least afforded some entertainment for the good citizens of Paris, and has added, in a sense, to the gaiety of nations at a time when a touch of humor such as this is only too welcome.

Wheat and Ships

WE may perhaps, safely assume that it is now understood why our Allies must have wheat instead of something else or nothing at all. So much has been written under this head that it seems hardly unfair to conclude that those who cannot see are those who will not see. The essential facts are as portrayed graphically in the map on another page of this issue. Let us, then, accept the statement that England, France and Italy between them must import 450,000,000 bushels of wheat before the next harvest, and that of this total 100,000,000 bushels are coming from Canada Where will the balance of 350,000,000 bushels be found?

Now, in addition to Canada and the United States, and excluding Russia for obvious reasons, the world's great wheat-growing centers are those of Australia, Argentine and India. Australia had, last year, such a prodigious crop that she had to store much of it in the open pending the construction of temporary cover. Her surplus available for export is 150,000,000 bushels. At the same time Argentine has a surplus of 100,000,000 bushels; and India can spare an amount which, in the absence of authenticated figures, we can only assume to be up to the mark of 100,000,000 bushels necessary to complete the tale.

Here, then, in these three places, we have all the wheat the Allies need. But shipping conditions are such that it is not possible to get it thence to them. From Australia and India the only route now available is that via the Cape of Good Hope, the Suez alternative being ruled out by the fact that the Mediterranean is the zone of greatest danger and least protection from the U-boats. On this basis, it is 12,500 miles from the Australian ports to Liverpool and 12,000 miles from Bombay; while the trans-Atlantic passage from Buenos Ayres is one of 6,250 miles.

It is obvious enough that it will take more ships and more time to haul a given amount of wheat 12,000 miles or 6,000 miles than to carry the same cargo 3,000 miles, the average distance of the North Atlantic seaports from Western European points. But until we submit the situation to careful analysis we can get no adequate idea of how serious the difference is.

It takes 48 pounds of wheat to make a cubic foot, and 1¼ cubic feet to make a bushel. Accordingly, at 60 pounds per bushel, there are 33⅓ bushels of the grain in a ton. The amounts mentioned above as available in Australia, in India and in Argentine reduce, on this basis, the first to 4,500,000 tons, the other two each to 3,000,00 tons. Multiplying each of these figures by the corresponding mileage, we discover that to move to Europe the wheat surplus of Australia would employ 56,250,000,000 ton-miles of shipping; of India, 36,000,000,000 ton-miles; of Argentine, 18,750,000,000 ton-miles. As a net result we have that in meeting the wheat needs of our Allies from these quarters we would be obliged to use up 111,000,000,000 ton-miles of shipping.

If, on the other hand, we convert 350,000,000 bushels of American wheat into 10,500,000 tons, and ship this amount over the 3,000-mile route from Boston and New York and Montreal, we shall come off with an expenditure of barely one quarter as much shipping—31,500,000,000 ton-miles, to be exact.

Comment is hardly necessary. Even the latter figure involves 3,150,000 miles of steaming by 10,000-ton ships, or 6,250,000 miles of service by 5,000-ton vessels—and the latter figure comes much nearer the average for the available bottoms than does the former. This is in itself a serious enough drain upon our resources; to multiply it by four would be quite out of the question. It would be out of the question if there were involved no element of exposure to hostile attack. But there is such exposure; and it is almost superfluous to point out that the danger zone is vastly wider for vessels approaching England from the south than for those sailing into port from the west.

It is true that we have no wheat left for export, save what can be got by reducing our normal consumption. But we can, in this fashion, get wheat; and we cannot, in this fashion, get ships. So there is but one answer; we *must* save the wheat and ship it over the shorter and safer route, to our Allies. In no other way can they be fed; for multiplication of our available shipping by four is not merely inconvenient—it is impossible.

Germany's Plans for Mining the Sea

IT is quite in accordance with the general fitness of things that since the very start of the war the Germans have sought to make every possible use of the mine. The submarine mine is, of course, a perfectly legitimate weapon of naval war, but it is not one of those that make any great appeal to the average clean-minded man; and it goes without saying that the Germans have never hesitated to use it, contrary to the terms of the Hague Convention to which they pledged themselves, both by scattering it broadcast on the high seas, planting wide areas without notifying shipping, and laying fields with the sole object of entrapping merchantmen. All these things were forbidden by the Hague Convention.

As the war has progressed the cult of the mine in Germany has expanded rapidly. The first fight in the North Sea occurred on August 5th, 1914, when the German auxiliary "Königen Luise" was interrupted by a British destroyer flotilla while laying mines off the English east coast, and sunk. The light cruiser "Amphion" came to grief in this mine field next day. The first evidence that the Germans were fitting their ordinary warships as minelayers came in December, 1914, when, after the "tip-and-run" bombardment of English northeast coast towns by a squadron of fast German cruisers, a great number of mines were found to have been deposited in the vicinity, the sweeping operations occupying nearly a fortnight.

The regular warships used their mines for other purposes as well. The German Staff very sagely calculated from the beginning that the great majority of encounters in the North Sea would rapidly and inevitably develop into a chase—the German ship leading and the enemy pounding along behind struggling to disable her before she could reach the security of her own waters. They therefore fitted large numbers of thier ships with stern shoots through which mines could be dropped in the hope that the pursuing vessel would run up against them. A later trick was to couple the mines together by a long rope, which the enemy might engage with her bows and so draw the mines into her sides. It is known that no vessel has ever been mined by these methods. Another development of German cunning in this direction took the form of passing a long tube through a partially submerged mine, so that an enemy ship might mistake it for a periscope and ram it. It is said that this ruse was first discovered by some fishermen, who, sighting one of these decoys, really thought it was a submarine and proceeded unconsciously to put into operation certain instructions that were actually given to Russian naval officers in 1904-5. They tied a noose in a long rope, lassooed the "periscope," and towed their prize into port!

It is not known exactly when Germany first began to use submarines for mine laying, but it is believed that at least a hundred vessels of this type have been passed into service, of which from 40 to 60 per cent have been accounted for in one way or another. The majority of them are identified by the letters "U. C." and a number, and of these the U. C. 5, exhibited here in connection with the Liberty Loan, was a fair sample. She belonged, however, to the earlier and smaller groups, and was fitted to carry only 12 mines. Later U. C. boats have nine tubes (where the U. C. 5 had only six) with two mines in each; and there is also in service a score or so of submarines which, originally built for ordinary U-boat work, have since been converted into mine layers. These retain their original armament, but carry only one torpedo for each tube instead of the usual two or three, the saving in weight being absorbed by the shipment of 36 mines with the necessary dropping gear. It is worth recalling that the first modern submarine built for mine-laying was the Russian "Krab," launched at Nikolaieff on the Black Sea in 1912. Displacing 492 tons, this vessel was armed with two torpedo tubes, and, it is said, could carry 60 mines. The number in any case must depend upon the weight of the individual mine and the extent to which other characteristics are sacrificed, as well as upon the size of the vessel.

Within the last year or so the Germans have greatly extended their preparations for laying mines from surface ships. Only two regular seagoing minelayers existed at the outbreak of war in the German fleet. These were the "Albatross" and "Nautilus," built in 1906-7, displacing about 2,000 tons, and designed to carry 400 mines each. The "Albatross" was driven ashore by a Russian squadron in July, 1915, was subsequently salved, and is now interned in Sweden. It is known, however, that a large number of the older small cruisers have been adapted for minelaying, while the same purpose is borne in mind in the construction of all new ships. As a typical instance there is the new "Emden" class, at least six in number, which, on a tonnage of 5,400, combine an armament of ten 5.9-inch guns and a speed of 28 knots with a supply of 120 mines.

Much more remarkable, however, is a new group of minelaying cruisers, believed to be six in number, of which four are named "Bremse," "Brummer," "Natter" and "Skorpion." These vessels are understood to displace no more than 4,000 tons, and to carry the relatively heavy armament of four 5.9-inch and eight 4.1-inch guns with a speed of 35 knots. On top of these striking characteristics, each ship is to carry a large supply of mines. The place of these vessels in the German scheme of things is not clear. They may be intended to act as a rearguard and lay down a barrage between the German and a hostile fleet if the two should ever meet again at sea; they could impose infinite and monotonous labor on the British mine sweeping flotillas by dashing out into the North Sea and scattering their mines indiscriminately. Or they may be intended to run the gauntlet of the North Sea blockade and deposit their spawn off the American coast or in the probable track of American transports. The enterprise of the Germans in this direction is shown by the career of the recently returned raider "Wolf," which not only sowed mine fields at various places between South Africa and the Far East, but actually fitted out the captured steamer "Turritella" as an auxiliary minelayer. The latter was soon overhauled, and was scuttled by her German prize crew to avoid capture.

It is clear from these and other facts that the Germans are developing their minelaying policy for all it is worth, and what this means to those lying within easy reach of their bases is evident from the official statement that during 1917 one thousand mine-sweepers were constantly employed round the British coasts, 3,000 square miles being covered every day and a total of 4,600 mines swept up.

Naval and Military

Allies Secure 870,000 Tons of Shipping.—In a single day, the United States Navy crews took possession of 68 Dutch ships with a total tonnage of 470,000, that were lying in the various ports of the United States. At the same time, Great Britain took over Dutch ships with a total tonnage of 400,000. The total of 870,000 tons thus added to the shipping of the Allies is about fourteen per cent of the shipping losses of the world for the year 1917.

Motor Truck Versus U-Boat.—This is not, as the title might suggest, a story of amphibious warfare, but of an accidental sinking of a U-boat which surely is unique among the annals of the sea. The story, as told in the *Naval and Military Record*, relates that the submarine rose to the surface to shell a ship which she had torpedoed, and that the first shell exploded the latter's cargo of munitions. A large motor truck on the upper deck of the vessel was flung into the sea by the explosion and landed squarely on the upper deck of the submarine, sinking her instantly.

Shipyards for Large Ocean Carriers.—The Senate Commerce Committee has decided to approve the suggestion of Mr. Piez, the General Manager of the Emergency Fleet Corporation, that new shipyards, one Government owned and one privately owned, be built at once for the construction of the largest ocean-carriers. It it was the opinion of the Committee, after reviewing the capacity for the ship construction here and abroad and comparing it with the destruction by submarines, that the additional yards should be built in order to hasten the time when the construction of new shipping will materially exceed the losses through submarine attack.

Huge Appropriation for the Navy.—The House Committee on Naval Affairs has reported a naval appropriation bill which will carry a total of $1,325,000,000. This is the largest single naval appropriation bill ever made for the United States Navy. It calls for an increase in the Navy personnel from 150,000 to 228,000 men, and the Marine Corps is to be raised from 30,000 to 50,000 men. Other items are $78,000,000 for ammunition; $50,000,000 for reserve ordnance supplies; $48,000,000 for new batteries for vessels. The amount named in this bill exceeds by over $800,000,000 any appropriation hitherto made for the Navy. The total expenditures of the Navy from 1794 to 1916, throughout a period of 122 years, exceed the amount asked for in this bill by only $360,000,000.

Liberty Motor in Service.—Amid the prevailing uncertainty as to just what has been accomplished in the field of aeronautics, the frequent rumors to the effect that the Liberty Motors are not showing uniformity of quality, are certainly very disquieting. Whether or not a Liberty Motor can be made by quantity production methods depends upon the quality of the output. Can the average mechanic when employed on airplane motors be trained to work to the finest micrometer measurements? There is probably no machine in the world, and certainly no internal-combustion motor, that is run for such long periods under its greatest possible output of power as the airplane motor. If it is to stand up under the continuous, full-power duty, it must be built with the most scrupulous nicety of materials and adjustment. Its success is a question of conscientious work in forge, heat-treatment shop, lathe, milling machine and erecting shop.

Growth of Our Army in France.—Secretary Baker stated to the Senate Military Affairs Committee that one and one-half million of men would be in France in 1918, "if the transportation facilities are available." It has been frequently stated that it requires five tons of carrying capacity for each soldier and his equipment. If this be true, 300 ships, each carrying 5,000 men, would be required to place those 1,500,000 soldiers in France. But it takes a large trans-Atlantic liner to carry 5,000 men. The "Leviathan," the largest of them all, is rated to carry about 10,000. We have only one ship of that size available and very few of them can carry 5,000. Indeed, 2,000 to 2,500 men is a fair average. Hence, it can be seen what a vast fleet is necessary merely to carry the men over. Another fleet of ships is necessary to keep them supplied; and above that a very large tonnage is needed to carry food and general supplies to our Allies. Little wonder is it that the cry has gone forth from the European nations comprising the Entente as well as from our own people for "Ships, ships, and yet more ships!"

Science

Fictitious Lakes in Arkansas.—At intervals during the past four years, Prof. H. C. Cowles, of the University of Chicago, and Mr. E. W. Shaw, of the U. S. Geological Survey, have made an investigation of certain apparently mythical "lakes" which have been shown on maps of northeastern Arkansas for the past 75 years. Both geological and ecological evidence prove that no such lakes could have existed within the past century, at least. How they came to be charted on the early land survey maps is a mystery. Later cartographers have simply copied the old maps without verification.

The War Emergency Board of the American Phytopathological Society, which was organized at the Pittsburgh meeting during the holidays, held a meeting in Washington, February 9th-11th. The organization of this board is the result of a determination on the part of plant pathologists to do their part in winning the war. Certain problems of nation-wide importance are being handled. At the special meeting reports on these projects were made. A census of all persons able to do pathological work is being taken and encouraging progress was noted. Other projects on Fungicides and Machinery, Emergency Research, Plant Disease Survey, and Crop Loss Estimates were considered at some length. Plant pathologists have in the war conditions a great opportunity for service to the commonwealth, for there is no more vital feature in maintaining maximum crop production than that of the reduction of leakage due to crop diseases. The board is working with all existing agencies of state and nation.

The Need of a National Quarantine Service is set forth in the current report of the Public Health Service. At present there are only two important ports at which quarantine measures are not under Federal control; viz, New York and Baltimore. The legislature of New York State and the city authorities at Baltimore have both taken action to permit the transfer of the respective quarantine stations to the national government for a reasonable compensation, and their acquisition by the government now only awaits the necessary Congressional appropriations. A general law providing for transfers of this character was enacted by Congress in 1893. Quarantine procedure at American ports is, says the report of the Public Health Service, closely interwoven with other Federal activities, such as customs and immigration, and uniform quarantine methods are necessary in the interest of facilitating commerce, protecting the country as a whole from the introduction of disease, and adjusting international questions involving quarantine practice. It is a curious situation that, while the Government has been signatory to several international sanitary agreements, its representatives have not had control of quarantine procedure at some of our leading ports.

A MESSAGE FROM SENATOR JAMES HAMILTON LEWIS

THE first year of this war for America presents one of the most interesting pictures that the human mind has been permitted to dwell upon in any existence of man now recorded in history. Inclusive of the island population of the seas, America stood as a nation approximately of one hundred million people. The guiding spirit of such a nation was, of course, the states. For one hundred years these states had been educating its people to oppose all conflict in foreign lands, to withhold interference in foreign affairs, to resent any intrusion by foreign nations upon us, and to decline to make expenditures for army and navy or war preparation further than the bare skeleton of an army, the mere scouts of a navy, sufficient to serve as a nucleus of defense against invasion.

Suddenly and for the first time in our existance, the necessity to enter into foreign wars upon foreign soil, across the Atlantic Ocean, was forced upon the United States. Her people were compelled by events to revolutionize their ideals, reverse their policies, overthrow their resolutions, and start anew upon a course against which they had set their faces for a hundred years. Then the spirit of the people had to be changed from a spirit of indulgence to one of sacrifice; from an indulgence of excess to one of economy; from a lavish extravagance to a necessary parsimony; finally, from a disinterestedness, if not an indifference, in the affairs of the world to an active participation in the destinies of Europe and in the solutions of the problems of the world. With this she was compelled to instill a feeling of interest and a consciousness of responsibility for whatever transpired in Europe, and particularly as to the fate of those nations at war against Prussian autocratic princes.

When the nation was aroused, she gave to the world an exhibition of the most remarkable celerity, activity and accomplishment that any nations which have gone to war have shown in the last fifty years of modern civilization or in the last two hundred years of ordinary governmental experience. She put a million men in the field; she put two million reserves; she put two more million as a possibility; she put twenty-one billions of dollars at the service of the nation and seven billion as an advance to foreign nations, three billion as a reserve to them. She remodeled and reconstructed her navy, making it the second navy of the world from a standing that was fourth, and thus as the guarantor and the sustaining support of the governments fighting Prussia, America became the embodied symbol of success, the visible pledge of an ultimate and overwhelming victory.

UNITED STATES SENATE.

Aeronautical

Increasing the Size of the Gothas.—Recently the British brought down a large Gotha biplane at sea, which, upon examination, proved to be fitted with four 260-horse-power engines with two propellers in front and two behind. The span of this machine was about 130 feet, a crew of five being carried.

Color Screens and Aerial Photography.—Professor Pope stated recently at the Royal Institution of Great Britain that air photography for military purposes today is done with the aid of plates sensitive to the several colors of the spectrum. He said that during the past year or two important developments have taken place in that type of photography, which cannot be publicly discussed at present.

Pershing and the Big Plane.—Our Commander-in-Chief evidently believes in anticipating aerial developments and providing our fighting forces accordingly. In response to an inquiry, General Pershing has recommended at least two heavy and two light machine guns, adding: "We should anticipate the use of three Vickers synchronized guns and three Lewis unsynchronized guns on every airplane."

Airplane Ambulance in Actual Service.—We are reminded by the editor of *Flight* that the idea of an airplane ambulance is not altogether new. Attention is drawn to the work in this connection, during the Serbian retreat in 1915, when a number of severely wounded officers and others were conveyed by Paulhan and other French pilots from Prizrend to Vallona or Skutari, thus saving the lives of valuable men who could not possibly have kept pace with the retreat.

German Aerial Traps.—Some details are given by the frontier correspondent of the *Telegraaf* of a new method adopted for catching hostile airmen which the Germans are employing at Zeebrugge. Towards evening, it is said, they send up 20 captive balloons, without crews, and attached to electrified steel cables. The electric barrier thus created is claimed to constitute a great danger to all airmen coming into contact with it.

Parachute Lights to Betray Air Raiders.—One of the German pilots who participated in the recent air raid on Paris, in an account in the Berlin *Lokal-Anzeiger* of his experiences during this trip says: "Suddenly the French put 'lanterns' in our way. Above and beneath us, ahead and astern, they hung quietly in the air and with their blinding glare lighted up our planes. They are rockets with parachutes provided with their brightly burning fuses. Some special mechanism enables them to remain steadily for a full minute in the air. Sometimes dozens together appeared near us to show our machines to the anti-aircraft guns."

Death of M. Louis Seguin.—There recently passed away the sponsor of the Gnome aviation engine which played so important a part in the early history of the heavier-than-air machine—M. Louis Seguin of Paris, France. It was in 1895 that M. Seguin founded the Gnome motor business, which eventually produced the Rhone rotary engine. Although he is best known because of his contributions to aviation, his activities in engineering covered a much wider field. He was a grandson of Marc Seguin, the promotor of the tubular boiler and the suspension bridge; and with his brother, M. Laurent Sequin, during the passage of a peaceful life he carried out in fullest measure the engineering traditions of the family.

Binocular Vision of a Good Airman.—In speaking recently regarding the medical aspect of flying, Sir Watson Cheyne, the famous English doctor, among other interesting things states: "An important thing is the necessity of having true binocular vision, especially when traveling at a great speed, and of having a very rapid connection between the sight and the action; in fact, in selecting pilots, one of the most important points to ascertain is whether the binocular vision is good, and also the time it takes between the aviator seeing and taking action. Very often it has been discovered that one eye is not used at all. Many people are going about with one eye and are not using the binocular vision; that is an extremely dangerous thing. You could not allow a man to enter the Air Service unless you found he had proper binocular vision; otherwise he would kill himself and smash his machine." This statement, it is held by some, is a fallacy. The possesion of nerve has more to do with the success of an aviator than mere physical strength or keen vision. Many first-class pilots have bad sight, and one at least has but one eye.

One Year of War

Some Details of Our Military Contribution to the Allied Cause

By Hon. Newton D. Baker, Secretary of War

IN 1914 France, with the help of a small body of brave British professional soldiers, by a display of stern courage and an innate genius for war, had been able to meet the German pace of war and at the Marne conquered.

Then Russia dealt the Germans a staggering blow, invaded Prussia from the East and compelled the enemy to slacken his speed in the West.

Meanwhile England made ready for battle.

At the opening of the second Spring campaign, the pace of battle in the West again quickened. Germany was still the pace-maker and launched her fruitless assaults against Verdun.

Now it was the Allies' turn. England stepped forward and set the pace of war in the series of mighty drives known as the battle of the Somme. The enemy, though driven back, showed that he was capable of meeting this assault.

Through the winter months of 1916-1917, the French and British again speeded up their war preparations for another and even greater drive. Toward the middle of March of last year, the Germans gave way under the incessant pressure of the Allies and evacuated 1,300 square miles of French territory on a frontage of 100 miles from Arras to Soissons. The liberation of France had begun. It was at this juncture that the United States declared war.

Within three weeks after the declaration of war, the French and British High Commissions were in Washington conferring with us regarding war plans.

Marshall Joffre laid before us proposals which from the French point of view it seemed most expedient and useful for us to follow. While the French were naturally eager to have us despatch immediately to the Western Front a small fighting detachment because of the stimulating effect it would have on all of the Allies, it was far from the idea of either the French or British Higher Command that we should hurry our preparations unduly and send over half-trained, half-equipped, half-prepared men. The French as well as the British knew that they could continue to hold the upper hand in the West throughout the ensuing 12 months or more, no matter what might happen in the East. Though the revolution in Russia already seemed to point to a military collapse which would enable the Germans to concentrate their entire strength in the West, it was effectively demonstrated to us that if the United States could make ready for battle within one year, our assistance not only would not come too late, but, on the contrary, would arrive at the crucial moment to speed up the pace of the war to victory.

As proof of the fact that the initiative remained with the Allies, we have but to look over the list of great offensives launched by their armies.

Ten days after the United States declared war, the French began the Battle of the Aisne. A month later the British won the victory of Messines and captured 7,500 German prisoners. On the last day of July the battle of Flanders opened, which culminated three months later in the capture of Passchendaele. During this period the French were also hammering unceasingly in the West and as late as November their forces occupied important positions of the Chemin des Dames and took 10,000 prisoners. A month later the battle of Cambrai was fought by the British. What was the strategic situation as it confronted the War Department?

We did not choose our terrain; we could not choose our methods of making war. The principal theater of the war was France and Flanders. There the enemy stood deep in conquered territory. Ours was the duty to assist in driving out the invader.

Few among us knew anything of the real pace of war. We had a small number of efficient officers, a well-drilled body of Regulars, and a few National Guard units which had been recently mobilized on a war footing. We had had some experience in munition making. A nation of 110,000,000 people stood behind us. Every loyal American was eager to do his share and rallied enthusiastically to support his President, his Flag, his Country in the vital emergency confronting them.

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A triumvirate of standards that will lead the Allies to victory

Our task was clear to us from the first. We were faced with the problem of turning out with the least possible delay an efficient army, fully developed in all of its highly specialized branches of service, and at the same time preventing any one phase of our war plans, which might be more speedily carried through, from racing ahead and upsetting the equilibrium, without which the military machine cannot function.

In war we have two positive factors: *Men and Munitions;* and two negative factors: *Time and Space.* To unify and make interchangeable these factors, so that munitions and men will meet in space on time, was the end which we sought to attain.

The course of the war had been charted. We had joined in the conflict mid-channel. It was only natural that we should follow the sound advice and useful counsel of our British and French colleagues.

They warned us against attempting to put through too hurriedly any program which might in the first instance seem successful, but which would break down under the severe strain of war.

It is patent that it would have been most wasteful to call for a great number of volunteers and not have the clothes with which to equip them nor the rifles and guns with which to drill them. It would have been equally improvident to rely upon any haphazard system in order to secure either munitions or men.

Thus while it may have appeared on the surface to the casual and inexperienced observer that confusion and turmoil prevailed at the War Department and that the Military Establishment was breaking down under the added burdens imposed upon us, as a matter of fact our war plans were being carried through in a quiet, careful and methodical manner, based upon the expert opinion and sound judgment of the men who have in hand the building up of the Armies of the United States.

Some mistakes have been made during our first year of war, incident to the rapid achievement of the War Department program, but fortunately no error has been made of such importance as seriously to impede the progress of mobilizing, equipping and training the Army, and transporting it to France to the capacity of shipping facilities.

I will review very summarily what the War Department has accomplished during the first year of war.

Our task was to coördinate Man-Power with Munition-Power and adapt both to what we may call Tonnage-Power in order to arrive at our final result—War-Power.

To realize our Man-Power program without upsetting our Munition-Power program and at the same time not let either get too far ahead of our Tonnage-Power, was the problem which we set about to solve.

The Selective Draft recommendations were submitted to Congress as representing the fairest, most economical and speedy method of raising our armies. Congress without delay recognized the wisdom of the measure and on May 18th the President signed the Selective Service Act. On June 5th, nearly ten million men between the ages of 21 and 31 years, registered for service. We were thus assured of an inexhaustible supply of men.

Through the medium of the Provost Marshal General the Selective Draft was enforced. Our young male population was grouped and classified in such a manner as to distribute the war burden as equally as possible throughout the United States and to enroll our manpower without disturbing unduly the economic life of

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Five thousand artillerymen assembling on the drill grounds at Camp Hancock **Three hundred Army wagon transports going to the supply station at Camp Hancock**

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Non-commissioned officers being taught the use of cold steel by a British officer **Hurdling to victory. Training for a bayonet charge across "No Man's Land"**

the country. Our National Army had been called into being. The first quota was to be 500,000 men. To find quarters for these forces was in itself a stupendous problem.

In three months, the Cantonment Division of the Quartermaster General's Department built 16 cantonments, each one practically a small city, each comprising about 1,400 separate buildings and providing quarters for 47,000 men. This achievement is considered one of the most remarkable accomplishments during the first year of the war.

In the construction of these 16 cantonments, over twenty-two thousand individual buildings of many types were erected for the housing of the National Army while in training. The contractor's profits on the several contracts averaged only 2.98 per cent.

The immensity of this project is shown to some extent by the fact that about 650,000,000 feet of lumber was used, and that more than 80,000 carloads of materials and furnishings have been shipped to the different localities. All the buildings are durably constructed and can be used continually for many more years than the war is likely to continue.

The largest cantonments are Camp Lewis and Camp Funston, the first near Tacoma, and the second at Fort Riley, Kans. The total number of men in all these camps is about 752,000.

To provide officers for our new National Army, 16 Officers' Training Camps were established. The first camp opened May 15th, 1917, and during three months 44,000 candidates for commissions underwent a gruelling training for the honor of being placed in immediate command of our new armies. At the end of the period, 27,341 men had qualified for officers' commissions. A second series of camps was immediately opened and approximately 23,000 men were admitted, of whom 17,237 were awarded commissions on November 27th. A third class began training on January 5th of this year and is to graduate during this month. These men were selected almost wholly from among the enlisted men, including those of the National Army.

As a result when the first increments of the National Army assembled at the cantonments in September last, they found the camps ready to receive them and officers to drill them.

While the work of creating our draft armies was being perfected, the Regular Army and National Guard units were being made ready for immediate service overseas. No time was lost. Within 10 weeks of the outbreak of the war, our first contingent landed safely in France. It was soon followed by other units drawn from the Regular Army and National Guard which had been mobilized on a war footing. The Regular Army was rapidly increased from 5,791 officers and 121,797 enlisted men to 10,698 officers and 503,142 enlisted men; the National Guard in Federal Service, from 3,733 officers and 76,713 enlisted men to 16,893 officers and 431,583 enlisted men; the Reserve Corps in active service, from 4,000 enlisted men to 96,210 officers and 77,360 enlisted men.

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Sergeant illustrating the use of the bayonet at close quarters

In other words, the Army of the United States has increased in actual strength since April 6th, 1917, from 9,524 officers, and 202,510 enlisted men to 123,801 officers and 1,528,924 enlisted men.

During the next few months fresh increments will take up their duties at the cantonments of the National Army.

Although the majority of the men are destined for the line, modern warfare requires large numbers of highly skilled men for technical units and other branches of the service demanding special aptitude.

Therefore, a most comprehensive occupational census of our new armies has been taken. A personal organization has been established at each cantonment composed of men who have had experience in vocational service. The previous occupation, educational qualifications and preference for service of each enlisted man are recorded on individual cards. These records are classified, analyzed, filed, and the data collected is made available for the Divisional Commanders, thus insuring the best possible assignment of the men. This is a wholly new departure for us and illustrates the scientific methods which are practised in building up our war machine.

The driving power of an army depends directly on the health of the troops. This great responsibility has been placed in the hands of the Medial Department of the Army. This branch of the service now includes some 18,000 officers and 98,000 enlisted men. At the beginning of the war there were 373 Army Nurses. The full complement calls for 24,126 and it is probable that 39,000 nurses will ultimately be required. The activities of the Medical Department of the Army are manifold. Their work is not confined merely to the organization of base and field hospitals, as well as general and highly specialized work in modern pathology, therapeutics and surgery, but above all they are by scientific prophylaxis keeping our troops in fighting trim, which is even more important than mending the wounded. The Medical Department is entrusted with the inspection of all food supplies, the study of the true nutritive value of rations under different climatic and working conditions, as well the stamping out of infectious and preventable disease, etc.

The Division of Psychology supervises the examination of all enlisted men and company officers, assists in the selection of men mentally qualified for important duties and weeds out the unfit and mental defectives. This scientific supervision makes for war efficiency in the ranks and strengthens the morale of the fighting units by eliminating at the outset those not strong enough to stand the strain of battle conditions.

One of the most vital and difficult problems which the Army has to deal with, is the new gas warfare which the Germans inaugurated in April, 1915, when they delivered the first great gas attack near Ypres which resulted in the temporary demoralization of a section of the British line, and a large number of casualties. Since that time great advance has been made in this deadly

(*Continued on page 320*)

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French soldiers showing their American allies how to throw hand grenades **U. S. marines in France practicing the gas mask drill**

The Fight for Public Opinion

Meeting the German Offensive on American Soil

By George Creel, Chairman of the Committee on Public Information

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THIS is, in a new sense, a war of democracy. Conscription has had the effect in Europe of calling a delegate from every home into the trenches. In all the fighting nations except Germany, it has broken down the barriers of caste among officers and men. It has put a whole people on the firing line instead of merely a professional army. As a consequence of these things, morale at the front depends, more than ever before, upon the morale of the nation behind the front; and the fight for position on the field of battle is constantly accompanied and supported by a fight for position in the equally important field of public opinion.

The Germans are fighting in the latter field no less unscrupulously than in the former. In the field of arms they have made a campaign of frightfulness. In the filed of opinion they are making a campaign of lies. Both campaigns are based on a deliberate and cynical reliance upon the lowest elements in human nature. It has been proved that these calculations were fatally wrong in the case of the nations on the western front. In the case of the Russians, a people, weakened by ages of autocratic government, the German methods seem, at least for a time, to have been more successful. Frightfulness has terrified the Russians, and lies and false promises have divided them against themselves and broken down their power of self-defense.

But the only really shining success gained by either of these German campaigns is that gained by the campaign of lies among the German people themselves. From the beginning of the war the Germans have allowed Berlin to decide what they should believe. And Berlin has always had a belief ready for them on every point, and has never shown any squeamish preference for a belief that happened to be in accordance with the facts.

There was once a famous prophet who had great honor in his own country. One night he was kept awake by a crowd that had gathered in the public square outside his house to watch an eclipse of the moon. He told his servant what to do about it. The servant went out and announced to the crowd that by order of his master the eclipse had been postponed for a week. And the crowd went home and went to bed without troubling to take another look at the moon.

In the same way, the Kaiser profits by the carefully fostered gullibility of his people. The Germans spent 43 years preparing for this war. They taught their young men the goose-step and the art of turning an occupied region into a desert. They stored up guns and ammunition and filled the celebrated war treasury at Spandau with gold dedicated to the one purpose of waging war. But the most important of all their works of preparation was the preparation of the German mind. It had been a good mind, but always tractable. The militarists in Berlin grasped it in a mailed fist, and moulded it to the Imperial will. They devoted highly special attention to the faculty of credulousness. In July, 1914, the official news agency printed forged despatches showing that the Russians were invading East Prussia without any declaration of war; that the French were advancing through Belgium and that French aviators had dropped bombs on Nuremburg and South German cities. German readers did not for a moment question the truth of these official reports. Hence they could have no objection to invading Russia, Belgium and France—in self defense.

The Nuremburg story was so absurd that it was later repudiated. But that story, and other lies, equally complete, had done their work. They enabled the Berlin militarists to get their people off with a good start. And from that time to this Berlin has never ceased its daily propaganda of falsehood and deception among its own people.

Outside of Germany the German lies have been used in two ways. In neutral countries, they have been invented to misrepresent the issues of the war, to slander the foes of Germany and to canonize the Fatherland. In enemy countries, they have been coined and circu ated to weaken the confidence of the people in their government, and to create every possible dissension between classes, between religious sects, and between political factions. Here in America we had nearly three years of the first kind of lying, and we have now had a year of lying of the second kind.

The Germans are trying out against us the same kind of propaganda that they used last year against the Italians with what came all too r ear to being complete success. They have not neglected to try out these lies also in France and England. But partly because the French and the English have been too busy to listen to lies, partly because they are naturally too shrewd to listen to them, and partly because measures have been systematically taken to hunt the lies down and root them out, the morale of France and the morale of England have never suffered much.

One of the most effective enterprises of the German propagandists in Italy and in Russia was to stir up religious dissensions. In America, religious differences have never caused any large amount of trouble, but the men in this country who are paid to lie for Germany, or who are making it their business to lie for Germany, propose to make the most even of sectarian animosities. Hence, they manage d to put into circulation the report that the Masonic orders have protested to the Government against allowing the Knights of Columbus to build recreation huts for Catholic soldiers in the camps; that Catholic nuns have been refused permission to do Red Cross work unless they discard their conventional habits for the regular Red Cross uniform; and even that the President's secretary, Mr. Tumulty, had been convicted of treason, because he was a Catholic, and taken out to Fort Leavenworth, and stood up against a wall and shot. All these stories, and many others like them, have been very promptly marked as lies, and the public warned against them. They are designed to encourage the wholly unfounded and disruptive notion that the Government of the United States is practising religious discrimination.

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Translations of President Wilson's message being attached to Montgolfier balloons and sent over the lines to the Germans

Another division in our population which the Germans are still more intent on widening is the division between capital and labor. So far nothing is clearer than that this war is everywhere placing in grave jeopardy the privileges of the capitalist—unless it is that the young men of the capitalist class are losing their lives at the front in considerably greater proportion to their total numbers than the proportion that obtains for the less well to do. Yet the old lie goes merrily on, under the influence of continual spurring, that this is a rich man's war, and that the poor do all the fighting in order to secure fresh markets and increased profits for the rich slacker.

It has been necessary continually to point out that the record of the President is absolutely clear and clean on this point; and behind the President stand Congress and the American people, rich and poor. Mr. Wilson proved in the Mexican affair that America would not fight for trade advantage. In the management of war business, Mr. Baker and Mr. Daniels and the other department administrators are proving every day that they are far from permitting any encroachments on the rights of labor. Such obvious facts as these have thus far prevented the Kaiser's agents from starting a class war in America as they started one in Russia.

Another great class of lies is intended to hamper the work of the Food Administration and the Fuel Administration. There are people abroad in the land who profess to know on authority that Mr. Hoover is the gluttonous head of a family of gluttons, that interned Germans have five meals a day, that damaged food is being given our soldiers in the cantonments, and that the Allies are selling American wheat to Germany. There are rumor mongers inspired from Berlin, and others who merely like to appear worldly wise, who whisper of vast profits reaped by district fuel administrators in the days of the closing orders. The interest of Germany in such stories is clear. Such control as these agencies are exercising, though especially irksome to a people normally so easy going as the Americans, is absolutely necessary now to the success of the nations arrayed against Germany. Undermine food control, undermine the supply of fuel to ships and munition factories, and you undermine democracy itself.

A type of falsehood very dear to the heart of the German agent is the story of a whole convoy of American transports sunk far out at sea by submarines; the story of a naval engagement in which nine American battleships were lost, the story of American divisions sent to the western front only to be abandoned there by our allies. The lie with which the German himself has been most thoroughly inoculated by Berlin is the absurd theory of German invincibility, the superstition that measures taken against her are doomed to disaster from the start. There is a sensational and morbid interest about these disaster stories that makes them irresistibly attractive to some of the least sensible classes of American citizen. This kind of propaganda, searching out all the weaklings at the front and behind the lines, had much to do with the Italian retreat. It fostered the spell of "defeatism" from which France suffered at the beginning of last summer. Here in America it will be a danger that loyal citizens will be constantly ready to oppose, in whatever form, and in whatever quarter.

There are falsehoods to deceive the simple and falsehoods to confuse the wise. Of the first class are stories that Uncle Sam is about to confiscate all money on deposit in our banks; that the grain sent to Europe is all made into whiskey; that American soldiers are instructed to put out the eyes of all captives; that every A nerican soldier is given a bottle of poison to drink in case he is taken prisoner; that there are 10,000 Englishmen in Colorado waiting, heavily armed, until all the American forces have gone to France, at which time they will issue from the mountain fastnesses and annex this fair land to the British throne; that in the military camps in Texas our drafted and enlisted men are being choked to death by the terrific dust at the rate of forty a day. And these are but samples of the sort of thing the confiding public is asked to believe—which it serves Germany's interest that the public accept as truth.

Of lies to entrap the wise, perhaps the most insiduous are those which profess secret information from the highest sources that our war measures are all only a bluff, and that President Wilson wants to gain his ends by that bluff if he can, but that he will under no circumstances consent to any real fighting. The danger of these stories lies in the fact that they seem to derive a certain plausibility from the dual nature of the President's efforts—his attempts to influence public opinion in the Central Empires at the same time that he is carrying on warlike operations against them. There are those persons who can see a forceful course of action only in a blind plunging forward, in reckless disregard of every consideration except that of bringing a maximum of violent effort to bear on obtaining one single object in one particular way. The diplomatic and the military offensives, for the present, must be carried along together. As long as this situation holds, there will be those who will insist that one side of the policy must be the real policy and the other only a feint. The fewer these people are the more successful the American policy is likely to be.

In barber shops, in smoking rooms, in sewing circles, and in all other places where people get together, the campaign of lies goes forward. He is a good citizen who is slow to believe all that he hears and very much slower to repeat anything that he hears. The government is pledged to a policy of frankness in giving out promptly all news from the front, all official reports of conditions in the training camps at home and all departmental investigations that show irregularities or mistakes or failures in administrative offices, so that complete frankness may win the complete confidence that is necessary if the country's war measures are to have an effective popular support. Against this policy the campaign of Geaman lies and German deception has been thus far a failure. In the fight for public opinion the Government has won.

Correspondence

The editors are not responsible for statements made in the correspondence column. Anonymous communications cannot be considered. but the names of correspondents will be withheld when so desired.

Greatest Question of the Hour

To the Editor of the SCIENTIFIC AMERICAN:

The greatest problem confronting the United States in the present hour is the shipping question. Food, fuel, munitions, general equipment are all urgently needed, but the call for ships is more pressing than any one of them. Upon our ability to bridge over the 3,000 miles, separating our shores from those of our Allies with a string of ships for continuous transportation of food and ammunition depends, absolutely, the question of our success or failure in this war.

The problem is not merely to build a large fleet of ships but to do it *now*. The gain in time is an essential condition for bringing the war to a successful end.

My proposition aims to provide means for an increase in shipping tonnage in the shortest possible way. As conditions are standing at present we must admit that, even with the great multitude of shipyards which are being built, a long time will elapse before the ships will be fully equipped with machinery ready for sailing under their own driving power. For the hulls must be very accurately laid out for the installment of machinery, and then the propelling engines with their many auxiliaries for equipping all these new ships can not be had in a short time.

Fortunately an experiment was made by our Navy some two years ago which, if properly adapted to the present shipping conditions, would be one of the weightiest factors resulting in doubling the output of shipping tonnage in a short time. The experiment was carried out on the oil tanker "*Maumee*," a vessel of 14,500 tons displacement and 475 feet in length, which was constructed at the Mare Island Navy Yard, San Francisco, Cal. The heavy oil engines for this ship had been built at the Brooklyn Navy Yard. The Navy was then confronted with the following propositions: either to transport the engines, which weighed in the neighborhood of one thousand tons, by rail or ship, via the Panama Canal, to San Francisco or to tow the hull from there to New York, a journey of 5,260 nautical miles. After careful consideration of the different propositions the Navy authorities decided for the latter. And so, on the 2d of February, 1916, the "*Maumee*," after having been loaded with California redwood as cargo, was taken in tow by the repair ship "*Prometheus*," a ship of 12,500 tons displacement, and started for the Brooklyn Navy Yard.

The trip from San Francisco to Balboa, a distance of over 3,000 miles, equal to the distance from our shores to Europe, was covered without stop at a speed of over nine knots. (See *Marine Engineering* of February, 1917). The entire undertaking was accomplished with complete success from start to finish.

Now, if it was possible to tow successfully a ship of 14,500 tons for an ocean trip of over 5,000 miles by a ship of 12,500 tons, at a maximum speed of 16 knots, it should not be difficult to tow, let us say, some of the 5,000 and 7,000 ton ships, which are now being built by the Emergency Fleet Corporation, across the Atlantic, without any serious towing mishap. The sudden strains arising from the plunging and slewing of the vessel were overcome, in the case of the "*Maumee*," by means of special towing machinery; and the same kind of towing gear could be used in case of the new ships, and a series of special designed compression springs could be used for the smaller ships.

The towed vessels would have to be provided with small steering engines, to steer in the course of the towing vessel and for zigzagging purposes.

In this way, by completing a certain proportion of the new ships as cargo-carrying vessels, without installing machinery, to be towed by available ships of considerable speed, the shipping tonnage could be nearly doubled in a short time. Otherwise, many months would be consumed in equipping them with machinery.

There is another advantage in this plan, not less important than the one of tonnage increase. It permits the finishing out of these cargo ships as nonsinkables, by merely dividing them, by means of cross and longitudinal bulkheads into short compartments, say, of fifteen feet length, so that in case two or three compartments are destroyed by a torpedo, the remaining compartments will keep the ship afloat, saving vessel and cargo. These bulkheads made out of plates or concrete, would contribute at the same time to the strength and rigidity of the ship. It is to be seen that the ship would be turned out as a nonsinkable without much additional cost. The only accommodations necessary would be those for the limited crew and the gun detachment.

In connection with the case of the "*Maumee*," it is interesting to consider the data obtained on trial trips of some of the ships. For instance a certain vessel required 602 horse-power for a speed of 12 knots, 1,250 horse-power for a speed of 16.5 knots and 11,531 horse-power for a speed of 30.2 knots. A larger ship required 2,485 horse-power for a speed of 10 knots, 7,372 horse-power for a speed of 15 knots and 23,312 horse-power for a speed of 20 knots.

The first ship could, therefore, tow another ship of her size at 12 knots; and the second ship could tow one of about 27, 500 tons at a speed of 10 knots and still leave a margin of 2,402 horse-power (7,372−4,970 = 2,402), to make up for inefficiency of the propellers in towing.

The objection that the reduction in speed increases the submarine danger, is not so serious when we consider that most of the new merchant ships will have a speed of only about 10 knots. According to the later reports, concrete hulls could be launched in about six weeks' time. If, say, fifty hulls would be finished out for towing purposes, a tonnage increase of about 300,000 tons could be made in a short time.

This plan should be introduced at once for transporting materials to this country from Australia and Japan whereby many ships would be freed for the transatlantic transportation.

It is to be understood that all these nonsinkable cargo ships will be fully equipped after the war with machinery and fitted out as regular merchant ships.

MASSEY SITNEY, M.E.

Brooklyn, N. Y.

Papers for Our Soldiers

To the Editor of the SCIENTIFIC AMERICAN:

The Library War Service of the American Library Association is just in receipt of a communication signed by the Camp Librarians at Camps MacArthur, Logan, Bowie, Travis, Pike, and Doniphan, stating that there is in these camps a demand for the SCIENTIFIC AMERICAN, which is far in excess of the copies received through the Burleson "one cent" privilege. It is very desirable that more copies of the SCIENTIFIC AMERICAN reach them promptly from the original subscribers. On behalf of the thousands of reading men whom they represent, they ask us "in some emphatic way" to place this matter before your subscribers and see whether it is not possible to get more copies of this magazine into the post office under the Burleson Act. The need is urgent.

There is an over-supply of some magazines, but an under-supply of yours. We are of the opinion that this need of a supply exists at many other camps, and we, therefore, hasten to call this matter to your attention.

JOSEPH L. WHEELER,

Washington, D. C. Assistant to the Director.

Talc and Tires

To the Editor of the SCIENTIFIC AMERICAN:

In your issue of March 2d among the "Automobile" items the matter of the conservation of inner tubes was taken up, and along this line will you permit me to ventilate a few ideas which have been in my mind for some time?

I have been more or less skeptical as to the exact part played by talc powder when used on inner tubes or between the tube and the casing. I have run tires for many miles both with and without, and to prevent disastrous sticking, I have used finely pulverized graphite in place of talc with good results.

In the article above referred to you have mentioned "the constant movement between the casing and the tube" as "causing a friction that is destructive to the tube. Moreover, this friction, and that resulting from the constant flexing of the casing, heats the tire, causing the tube to stick to the casing, with the result that the tube is torn."

That you have described a situation which is anomalous will be apparent on analyzing the above. As soon as a tube sticks to the casing the movement between the casing and the tube ceases and therefore is not constant. More times than not when deflating a tire, particularly if it has been inflated for some time, one may hear the tube (especially if it is a new one), owing to its diameter being less than that of the inside of the casing, separating itself from the casing with the usual and very familiar sound even before one makes an attempt to loosen the tire and take it from the rim.

Hardly any one who has run a car for a considerable time but has had the experience of dismounting a tire only to find that the inner tube must be carefully separated from the casing, to which it has firmly adhered. What could better disprove the assertion that there is constant motion between the tube and the casing? Is further proof desired? Notice, in many cases, the impression the fabric on the inside of the casing makes on the surface of the tube that has been in contact with it for a long time. Assuming that with lubrication relative movement between casing and tube is possible, if the casing and tube should be scrubbed clean with gasolene the two clean rubber-to-rubber surfaces would permit no frictional movement. We must admit then that if there is friction between the tube and casing it is *because* talc or lubricant of some kind is present.

I do not advocate doing away with it entirely, for it is needed for an obvious purpose, but that this matter is imperfectly understood has been quite apparent to me for some time. I venture the opinion that in all but very exceptional cases 100 per cent of the heat developed in a tire is caused by flexing, and none by a squirming inner tube. The first thing the tube proceeds to do is to stick to the casing "closer than a brother."

CHAS. EDW. PRIOR, JR.

Hartford, Conn.

An Embarrassing Predicament

AT the expense of our good friend Mr. E. Moulié of San Diego, Cal., the soapnut man, we have demonstrated the advertising value of the SCIENTIFIC AMERICAN columns. Our readers will recall that in a recent issue we announced that Mr. Moulié was about to conduct a final distribution of the seeds of his interesting and valuable arboreal protegé. It appears now that Mr. Moulié overlooked informing us as to the precise terms under which he proposed to send out his seeds, and that our assumption that he was going to do it just as he had on previous occasions was a trifle hasty.

Mr. Moulié writes in great perturbation to inform us that his supply of the seeds is not so large as when he conducted their distribution from Florida seven years ago. Accordingly he planned to send only four of them, with six seeds of the tallow-berry (another of his hobbies) to each applicant. He had intended that each application should be accompanied by an addressed and stamped envelope, with three cents additional to cover the cost of the printed directions for planting and rearing the soap-nut tree; the seeds themselves were to have been free. The announcement which he had in mind would also have stated that the soapnut tree will not flourish where the temperature falls lower than ten degrees above zero; and that it will not stand transplanting, so that only permanent occupants of the land on which it is to be planted should apply for the seed.

The particulars that Mr. Moulié forwarded us were obviously not complete; and in order that the announcement of his distribution should be as little delayed as possible, we completed them, as we supposed correctly, by referring to our files for 1911 and copying the conditions of the last distribution of the soapnut seeds. Our judgment turns out to have been faulty, especially in the impression inadvertently given that Mr. Moulié was in a position to supply practically unlimited quantities of the seeds. The result has been to put him in a embarrassing position; for within a week of our publication of his notice, he had received nearly one hundred applications, enclosing various sums of money, and calling for an aggregate of 497 pounds of seeds!

Of course he has not 497 pounds of seed, or anything approaching that quantity; he is growing the nuts for seed, not for food. So he begs us to "square" him with his correspondents, so far as we can do so. Most of the orders which he has received will have to be returned, and the clerical labor of doing this will be considerable, so we ask our readers to be patient with him if there is delay in hearing from him. We would also remark that the person who took advantage of his official position to write to Mr. Moulié in a franked envelope, requesting a consignment of the seeds, and not even enclosing postage to send them with, will not hear from Mr. Moulié at all.

There is a certain element of humor in the situation, which even the harassed Mr. Moulié has appreciated. He had not supposed, from his previous experiences in trying to give his soap-nut seeds away, that the public interest would be nearly so keen as it has turned out to be; and accordingly he is agreeably surprised to find that the demand for his seeds is so great that he can not meet it. It appears that in this year of war, the nation is much more thoroughly awake to the value of new articles of food than ever before. Nor had Mr. Moulié intended that anyone should order six pounds of his precious seeds, requesting directions for cooking them. His seeds are meant to be planted, not to be eaten; his friends who want to eat them will have to wait till they have a crop of their own before they will be able to satisfy this desire.

Mr. Moulié is still prepared to start any prospective grower of the soap-nut tree and the tallow-berry on the terms stated above, and hopes for many applications. He wishes us to emphasize that applications which do not conform with the conditions outlined cannot be considered; also that the tallow-berry, which has never been formally introduced to our readers, is of great value, and endorsed by the Department of Agriculture. Finally he is a sadder and a wiser man as a result of this experience, with a vastly increased respect for the value of the SCIENTIFIC AMERICAN as an advertising medium, and for the ability of our readers to recognize a good thing when they see one.

The U. S. Navy Strips for Action

How Our First Line of Defence Expanded From a Peace to a War Footing

By Hon. Josephus Daniels, Secretary of the Navy

IT remained for the test of war to demonstrate the readiness of the American Navy for service, expected and unexpected. It had, too, to wait until actual conflict tested the spirit of its personnel and their zeal and efficiency for us to learn how safely it was anchored in the confidence of the American people. The test came on April 6th, 1917. The reward to the "web-footed" arm of the military service, as Lincoln called the Navy, came in many manifestations that, unknown to the people, in time of peace it was making itself fit for the duty the danger of the hour called upon it to perform. It is a proud satisfaction to every man in the Navy that in the day of stress the Nation turned to them for the first defensive and the first offensive, and that, as it has gone about its business of enlargement and improvement, the people have realized they had afloat a body of men and hundreds of ships dependable, fit, ready.

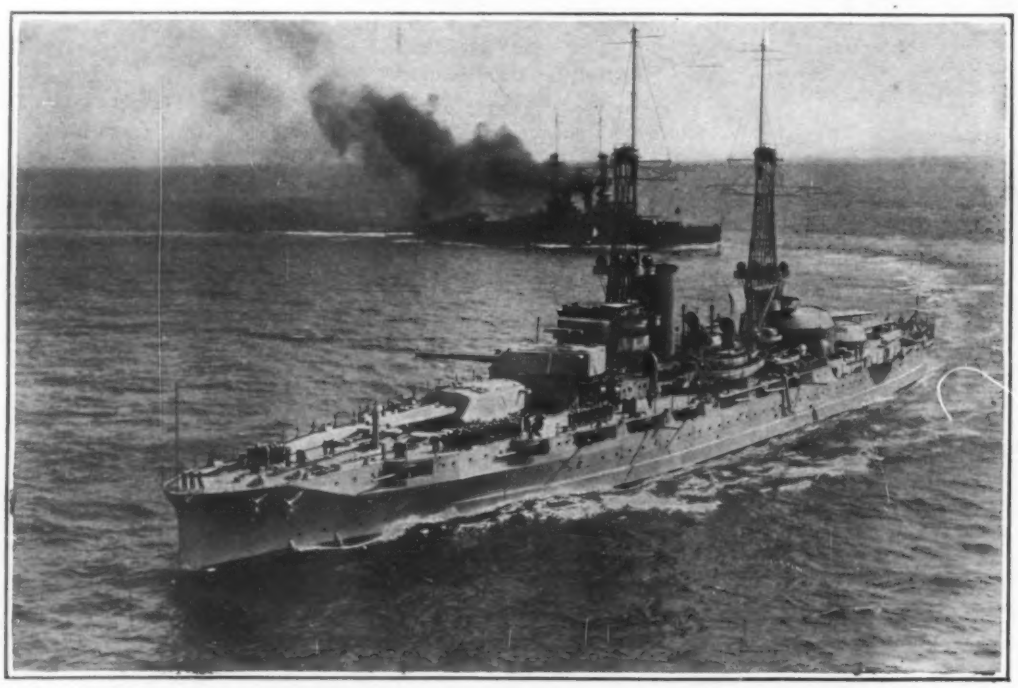
Nobody in the country in years gone by, ever dreamed that the Navy would be called upon to arm merchant ships and furnish expert gunners to protect them from submarines. And yet that was the first duty the Commander-in-Chief assigned to the Navy. The men in the big ships had been training to shoot big guns at big ships at long range. That was the thing deemed most necessary, as it was the most difficult. Hitting any target, big or little, at a distance of ten to fifteen miles, from a rolling emplacement, calls for the most skillful marksmanship. Practice with smaller guns at small targets had not been neglected, but it was regarded as secondary to big gun practice. So, when the call came to arm merchant ships and furnish gun crews to hit small periscopes, it was a large order. At first the "Mayflower," the "Dolphin" and the smaller craft were stripped of trained gunners for this hazardous and hitherto unexpected duty. It is a proud sorrow to the men of the "Dolphin," which in peace times is called "the Secretary's ship," that one of its brave young gunners, John Eopolucci, was the first to give his life in protection of America's resolve to maintain "the freedom of the seas." Immediately, the battleships were converted into training ships, gunners' schools were opened, and as fast as the call came for them, trained gunners were ready with a cheerful "Aye, Aye, Sir" to the call to danger and the struggle to make the seas safe. Big ships were denuded of their smaller guns to equip merchant vessels and work on new guns was hurried with unprecedented rapidity. This service lacks everything of the spectacular; it is not ordinarily regarded as military. Officers and men leave fighting ships to protect merchant vessels when their preference is for the first line ships and destroyers. It has been, it is, rigorous service without airs or popest. If the Navy had done nothing but respond as well as it has to this new assignment, it would deserve well of the American people. And it is a duty that increases with the increase in the task of carrying food and supplies to our allies and to our soldiers and sailors, fighting, in Europe the battle for democracy.

The world knows of the courage of the youths on the destroyers in their perilous work. It does not fully know that the young men of the Navy are keen for assignment where the perils of the deep are greatest. They have captured submarines and their crews; they have sunk submarines; they have saved merchant ships and preserved the lives of thousands of men and women by placing their own lives in jeopardy; and they have done these things, and more, in zero weather, amid hardships of which landsmen understand little, and with never a complaint or failure. They have not been alone. The men on converted yachts, on submarine chasers, on tugs, on mine-layers, on mine-sweepers, and other craft, in months of storm at a freezing temperature, with dangers ever present and nothing of comfort, have been quite as courageous and forgetful of self. On every sea, in harbors, in ice-floes—wherever an enemy might sail or sneak, these fighters of the sea, men and ship in understanding comradeship, have fought our battles and have fought them well.

On shore the ceaseless efforts of men in uniform and in civilian garb have been equally zealous to increase the fighting force by building new ships of the type most needed and putting into the best shape all naval ships. This has been a herculean task, for the country had ceased to be a ship-building nation. The ship-building trade, once honored, had become a craft. We had depended upon foreign bottoms to carry our commerce until we had almost forgotten how to build ships. The comparatively few skilled ship-builders could not turn out an average product, for they were suddenly called upon to train new men invited into the industry. The number of men engaged today in ship building has increased ten fold in six months, and the cry is still for more workers. But the new men are learning, and soon the ships now in the making will ply the seas—hundreds of them carrying guns to increase the country's sea power and more hundreds still bearing to France an ever increasing number of soldiers and the supplies and munitions that must feed and arm them in the titanic struggle they will undergo in their high resolve that liberty shall not perish from the earth. Since the beginning of the war—in one year—some eight hundred vessels have been placed in commission in the American Navy and over four hundred are building.

Not only has equipment for sea fighting, undersea fighting, and battles in the skies gone on apace (and we cannot yet perceive how great have been the plans and how large is the product in the process of the making), but there has been steady and intelligent instruction of the 250,000 new men who have volunteered to fight afloat. Schools of all kinds, training camps on shore and on sea, hospitals and hospital ships and hospital training have been given thought and direction. Fit men, skilled by practice, strong in mind and in body, filled with the patriotism that knows no counting of self, are the chief pride and reliance of the Navy in these epoch-making days.

All the increase of manpower and material power, all its supplies and munitions, all its preparations now and planned have not come by chance or accident, or in the brief period we have been at war. In peace times the Navy had been at work. Every agency had been getting ready. When war sounded there was no need in a single particular to change the organization. All that was needed was to put on more steam, secure more men and train them, build more fighting ships, and key up the machine to its fighting strength. This has been done. This is being done. What the Navy has accomplished in the first year of the war is but an earnest of the things it will do in the supreme crisis when dreadnought and cruiser and gunboat and destroyer and submarine, and



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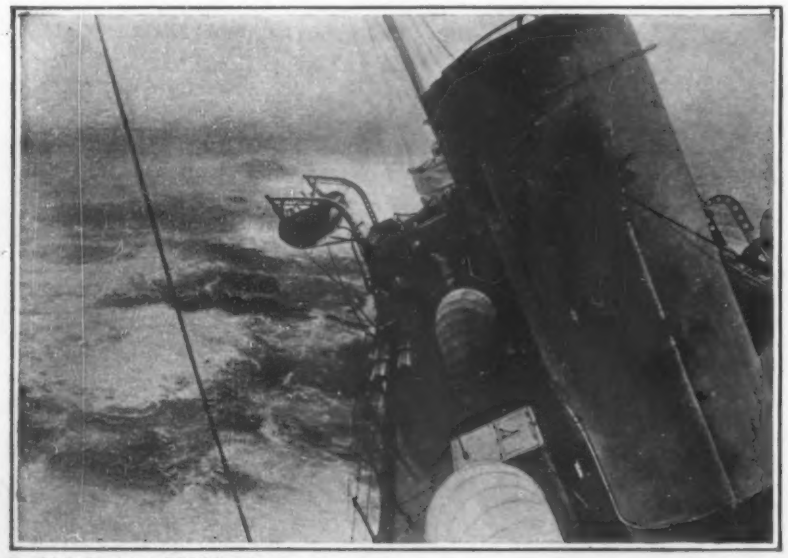
Dreadnought "Pennsylvania." Displacement, 32,000 tons. Armament, twelve 14-inch; twenty-two five-inch



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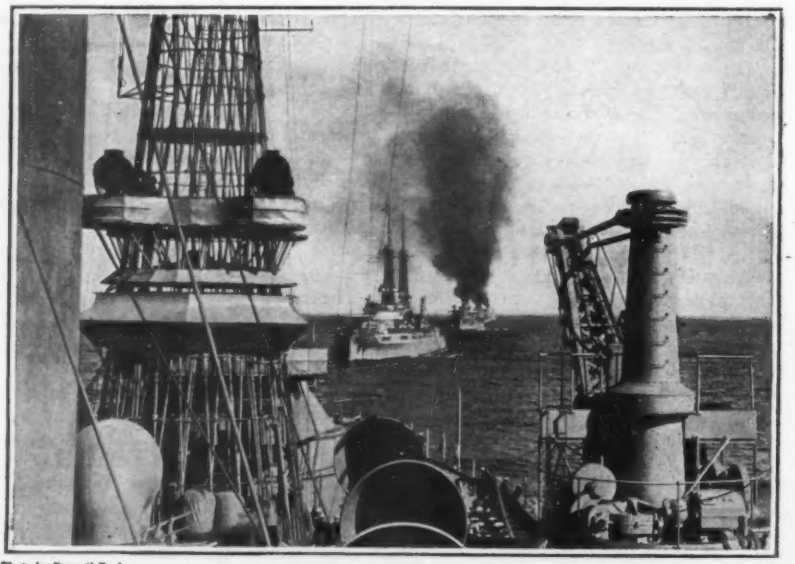
U. S. destroyer rolling in a rough sea



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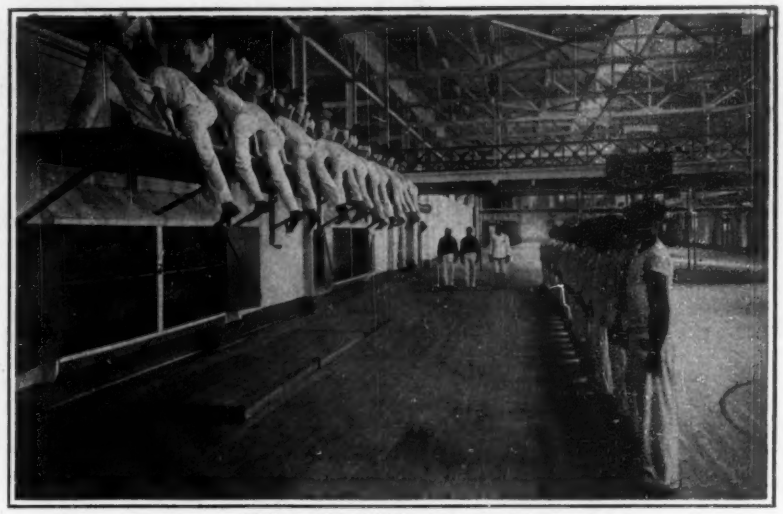
View from bridge of "Pennsylvania," looking aft

Swimming instruction at the Newport Naval Training Station



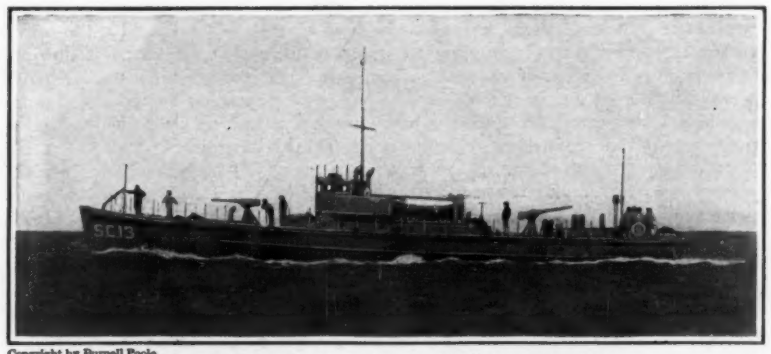
Wall-scaling drill in the gymnasium

every other type of craft that can make itself felt, will meet any shock and defeat any foe. And the earnest prayer of every man in the Navy is that the German fleet will soon come from its hiding and give battle in the open where courage and skill will win the day.

Science and invention have been requisitioned to meet the new character of sea fighting, for the submarine menace has changed the calculations and plans of naval experts and naval fighters. The mighty ships still remain the potential protectors of the ocean commerce; but the craft to fight submarines is the small and swift ship, the destroyer being the best yet perfected. The United States is now building more destroyers (and constructing them in half the time which had been customary in peace times)—more destroyers than there were in any other two navies before 1914, and in addition is hurrying the construction of submarine chasers and other types of similar ships, and likewise is providing seaplanes.

To the successful war on the submarines, the inventive and scientific genius of the world has been invited to make its contribution. The Council of National Defense early last year requested the Naval Consulting Board to act as the Board of Inventions of the Council. What this Board has been able to perfect and what is now under consideration and construction, it is not wise to state or to speculate upon. The problem is complex and difficult, and American skill and genius is challenged to find the antidote of the menace. It has accepted the challenge. In the Navy and out of it the difficulty of the solution makes the problem attractive to men of action and to men of science. Both are busy, both are making progress. Each hopes one or the other will find the best agencies and apply them so that more and more rapidly the seas will be cleared of the undersea assassins. Sir Eric Geddes, head of the British Navy, recently heartened the world by statements showing that the allies were sinking more submarines than the Germans could build. But this progress, though gratifying, is not satisfying the naval ambition. It has defeated German boasts, but it has not ended German destruction of men and supplies, though it lessens the havoc and has silenced those who feared that America could not safely send its millions to fight back the hordes of Huns in France.

Nothing is so fatal at this time as cocksureness. The country feels more confidence in an earlier victory over submarine sinkings because of the lack of boasting and over-confidence on the part of naval officers and civilian inventors and scientists. None of them expects to win by any widely heralded scheme of wholesale destruction or puts faith in the widely advertised quack remedies. Naval experts and scientists and inventors are alike modest in their claims and earnest in their studies and experiments. The practical man is looking to the scientist to evolve something he has not mastered while the scientists look to the practical navigators to evolve new agencies to end submarine warfare. Both are thinking of nothing else and both are making contributions, but neither has any spirit of cocksureness.



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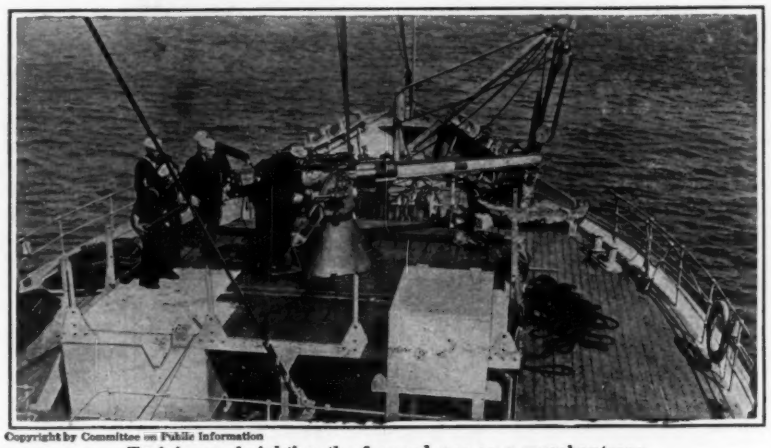
One of the new 110-foot submarine chasers on duty



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Training and sighting the forward gun on a merchantman

This state of mind was well illustrated not many weeks ago at the time when the destruction of ships was at its height, when a distinguished body of American and French scientists, who had been making experiments and exchanging ideas, called upon the Secretary of the Navy. As they were leaving, I said to them that the Navy and the country were looking to them to find the best and quickest remedy for the submarine and I wished to thank them for what they were doing and the things I felt sure they would do. One of the most distinguished replied: "Mr. Secretary, you may be sure the men of science will do everything they can do, but I beg that you not depend solely upon what science and invention may be able to accomplish. Depend more upon practical and unceasing work of the ships and the guns and the trained sailors, looking to us to give them the result of all we may learn." Just so long as we are using every weapon and every agency which experience and science now give, but looking ever for new and more effective ways, ready to adopt any and all from any source, just so long will confidence in overcoming the evil be justified. The only danger would be for us to suppose nothing new and nothing better could be devised. There is nothing impossible to daring and to science when they are working in conjunction.

Naval Growth of a Year

It is peculiarly appropriate to exhibit here, so close to Secretary Daniels' story of the Navy's achievement, figures showing the extent to which war has actually expanded the naval branch of the service. We need say nothing about ships—Mr. Daniels has covered this point, as far as it is advisable to speak at the present time. But it is distinctly of public interest to see just how largely the boys in blue have been augmented, and

(*Concluded on page 322*)

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A navy lookout in his winter costume

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Life lines on a destroyer, ready for rough weather

The Department of Labor and War Production

The Agency for Dealing with the Problems of Human Engineering

By Hon. W. B. Wilson, Secretary of Labor

IN no way has the war served more to emphasize the fundamental aspects of our industrial life than in the manner in which it has brought before the public the vital part which labor plays in production. Recent events both in Europe and in the United States have shown the importance of the labor factor to an extent which the public has never before realized. To the man who follows the course of the war, the history of the last year has demonstrated once for all that if industry is to be really mobilized for war it is not efficient unless the men who actually handle the machinery of production are organized and mobilized precisely to the same degree as the management of the plants and the machinery which they operate.

Yet to be organized effectively, the collection of citizens known in ordinary parlance as "labor" must be handled as a group of human beings, of citizens, not of machines. If the mobilization of industry can be termed essentially an engineering problem, the mobilization of the phase of industry represented by the labor engaged in it can be regarded as a problem in human engineering. It requires different methods and a different attitude of mind for its successful handling from the mechanical engineering problem. Yet its demand for scientific and specialized treatment, if different, is no less than that of the purely mechanical phases of the work. No government which neglects consideration of the labor aspects of production or which, if it considers these aspects, fails to deal with them on a modern, scientific and specialized plane as a human problem and thus infinitely more complex than any mere mechanical problem of business or industrial organization, can perform a really effective task of mobilizing industry for war. It has been chiefly —although not exclusively—on the Department of Labor that has fallen the task of dealing with this problem of human engineering.

The President's determination early in January to place on the Department of Labor the responsibility for organizing a more extensive and more centralized war labor administration has given the Department a still more prominent place in the Government's task of organizing the country behind the war. Before considering the plans now on foot for consummating the duties thus imposed on the Department by the President's order, let us consider just what the Department of Labor is and what it has hitherto done.

The most recently created regular Department of the Government, the Department of Labor, until 1913, was a branch of the joint Department of Commerce and Labor. The greatly magnified importance of "labor" as a factor in production, developed by the tremendous industrialization of the nation during the preceding fifteen or twenty years, brought about the separation of the Bureau of Labor in the Department of Commerce and its organization as a separate Department in 1913. It had only four years of existence, then, when the war came upon us in April, 1917. During that brief period its history had been one of slow but steady development. Its activities included particularly the gathering and collation of vital facts touching labor both at home and abroad and their distribution for the information of the American people—a work of education in other words; the administration of immigration problems; the beginning of the development of the national employment service, so far as funds and time permitted; the establishment of a small but growing conciliation service whose function it was to serve where requested by employers and employees as adjuster in cases of industrial dispute; and various allied problems brought forth by our industrial system.

On this basis, then, the Department stood when the war came. In many directions the work started at various stages of its four years' existence had only begun to develop. The ideas and policies underlying its activities were, in large measure, new and often misunderstood by many sections of the public.

Then the war came with its sudden and rapid demands for the intelligent use of labor in shipbuilding, in munitions production, in food production, and their innumerable variations and complexities.

Disputes which public opinion had hitherto chosen to regard as affecting only the parties immediately concerned became matters of national and vital import. Interruptions to production which had hitherto concerned only the civilian population, cessations of output which were of relatively small importance to the nation at large, were now seen as possible blows at the success of the armies of the United States and the Allies in the war. Strikes which had been regarded by the public press as unworthy of mention assumed a front page display. The nation was now concerned and it was beginning to realize the primary importance of labor in the great task of war production.

Yet the adjustment problem was not the only one which began to loom large in the public eye. There was talk of a labor shortage; and while investigation has shown with fair conclusiveness that there is no actual shortage in labor in the United States, there are many cases of shortage in particular industries and cases where labor is not distributed equitably among the various essential war industries. Machinery was seen to be needed to handle problems of distribution, of transportation, of housing, and the hundred and one other tasks which the public had before in large measure ignored. The war was performing its initial work of arousing the country to the vital character of the man power problem.

It was to the production departments of the Government—the Ordnance and Quartermaster Departments of the Army, those in charge of the Navy and Shipping Board program—that these needs first manifested themselves. Each of them in handling its production task found itself faced with the need of dealing quickly, wisely, and effectively with the labor question. Each proceeded to establish agencies for handling this problem, securing the coöperation of the Department of Labor and its experience with the general field, to assist them. The Department itself, further, while not directly concerned in the control of contracting and production, expanded its work in many directions to help out in the great task. The work of its conciliation service particularly broadened out in the whole field, while supplemented by the work of the special adjustment boards and services of the production departments in plants under direct contract to them. Steps were taken to expand the work of the employment service (utilizing all existing local agencies) to meet as far as possible the demand of the departments, and of private firms holding war contracts, for labor to perform the war task. The Bureau of Labor Statistics gave much of its attention to collecting material bearing on the labor experience of the warring countries abroad.

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The Hon. W. B. Wilson
Secretary of Labor

It is decidedly worth nothing that despite much popular misconception reports to the Department show that there are less strikes now in industrial plants than at any time in the history of the Department and that fewer controversies are reaching the strike stage than ever before. Much of the Department's work has been done so quietly that the public perhaps failed to realize these facts. They show the effectiveness of the Government's constant pleas for making stoppage of work the very last resort when war production is concerned and employer and employee fail to agree.

Yet despite these efforts the Department had not been organized and it did not have sufficient funds to carry out the work on the scale which the emergency required. Much confusion further arose through the lack of proper concerted action among the various agencies which had sprung up to deal with labor problems. In spite of the most earnest effort at voluntary coöperation it was impossible, in the nature of things, for the separate Departments, acting independently, to keep in close enough touch with each other to prevent confusion in adjustment work and to prevent their bidding against one another for labor which all alike needed. There was need for a war labor administration which could handle questions of adjustment on controversial points on a single policy; which would be in a position to find and furnish labor to the various war industries without conflict among them and with preference given to those whose need was most vital to the conduct of the war. There was need further—bearing in mind constantly that the administration of labor questions is a problem in human engineering and cannot be handled mechanically —of agencies to provide proper housing facilities for workmen and to see that they had proper means of transportation where communities had become congested; to see that human efficiency was not impaired by improper sanitation, overwork, or other bad local conditions; to provide training facilities where needed; to deal with the question of women in industry; to circulate information about methods of increasing production, employment management, and the proper handling of labor among the plant managers. If one part of the industrial system is touched it affects the whole, and necessarily the several production Departments could not deal individually with their own problems without affecting those of all.

A more centralized administration of the labor supply appeared indispensable, and early in January the President authorized the Secretary of Labor to establish such an administration. The plan now contemplated includes the establishment on an adequate national scale of the following new services:

- An Adjustment Service to deal with all industrial disputes.
- A Conditions of Labor Service to administer such matters as safety, sanitation and so forth.
- An Information and Education Service to promote sound sentiment generally and to provide appropriate local machinery and policies in individual plants.
- A Woman in Industry Service to correlate the activities of various agencies dealing with this matter.
- A Training and Dilution Service.
- A Housing and Transportation of Workers Service.
- A Personnel Service to deal with questions of personnel within the Department.
- A Distribution Service to consist of an expansion of the existing United States Employment Service.

This scheme will not involve the abandonment of the agencies already built up in the production Departments nor the loss of the experience which they have acquired. These agencies will as far as possible continue to expand. They will, however, look to the Department of Labor for guidance on all matters of general policy and their particular services will look to the new services of the Department of Labor for guidance, thus preventing conflict in policy and conflict in needs. Since the war labor administration must deal primarily with the emergency question of labor in war production and not with the more general question of the welfare of labor, the closest possible contact must be kept with the production Departments. An appropriation has been asked of Congress for the support of the new branches of the Department. We are undertaking a task for which no precedent has existed in America. Necessarily the establishment of extensive machinery will take time; yet the use and not the abandonment of previous experience and the fitting of these agencies to actual conditions in America argue for their ultimate success. The basic principle on which the Department will establish its policy will be one of trying to comprehend and to deal with the human factors involved in a human way and to proceed everywhere on ascertained facts, not on guess or impulse.

As a primary step in working out a policy for the adjustment service a conference is now sitting in Washington, composed of five representatives each of employers and employees, with two representatives of the public, the Hon. William Howard Taft and Mr. Frank P. Walsh, to arrive at some kind of understanding or agreement on controversial points which have arisen or are likely to arise between capital and labor for the period of the war. Many problems can be met by frank conference across the table between the two sides to a dispute. This is the democratic and human way to deal with the question. If these two groups can reach an understanding on the general principles of which interruptions of work can be reduced to a minimum during the war, the new Labor administration will have made a good start towards its ultimate goal—and through the application of a democratic principle as old as civilization.

Trapdoors to Release Grain in Case of Fire

AN excellent suggestion for saving wheat and other grain in country elevators in the event of fire has been made by a South Dakota builder. The idea is simple. Each bin for grain is provided with a trapdoor in the outer wall of the building, so arranged that in case of fire the door could be pulled open and the grain allowed to run out on the ground.

WAR MAP OF THE WESTERN FRONTS

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The large map shows the French theater of war, with the lines held by the combatants at the important periods since 1914. In the inserts are shown the Italian front and the American sector in France.

Bridging the Atlantic With Ships

The Fight for Our Line of Communications With the Battlefront

By Edward N. Hurley, Chairman of the United States Shipping Board

IF a bridge could be built across the Atlantic would any one doubt that the world would be made safe for democracy before the year was out? Men and supplies are useless without means of getting them to the fighting front.

So winning this war comes back to the vital need of ships. Upon the Shipping Board has devolved the responsibility of supplying this need under extraordinary conditions. We are told that the minimum requirement is 6,000,000 tons. America, whose flag had almost disappeared from the seas, is now expected to produce within one year more than three times the tonnage Great Britan produced during the two preceding years, 1,700,000 tons.

This call comes when most if not all of the established yards are rushing construction on dreadnoughts, destroyers, submarines, fuel ships, tenders and other auxiliary craft, and while munition makers absorb that part of skilled labor not called to government Navy yards or private plants.

But much has been done. First came the problem of new wooden-ship yards. Eighty-one new ones have been emplaced on tracts which a short time ago were barren spaces. And this represents indeed a great task, since to build a shipyard and then organize a staff to operate it, formerly required from one to three years before it could produce to maximum capacity. Shipbuilders can be made of men formerly engaged in other craft, but not all at once; nor can they produce a maximum output until they have found themselves.

The completion of the new yards was complicated by extraordinary difficulties. Much time had to be devoted to the old shipyards, which, owing to the severity of the winter, had difficulties with deliveries as well as with labor. But that task is nearly finished and when the new yards are working to capacity, we will be producing ten times the ship tonnage that was produced by all the yards of the United States in 1916.

It took Germany 40 years to build up her military machine. In less than eight months we have built up a shipbuilding machine, in the United States, which, when it gets into full swing, will defeat the military machine of Germany.

For the construction of wooden ships there are 332 launching ways built or in process of construction. Up to March 1st 281 keels for wooden and composite vessels were laid. Up to the present time 10 wooden ships have been launched.

On March 1st the total dead weight tonnage of the Ferris Standard 35,000-ton ships whose keels had been laid, amounted to 866,500 tons. Ferris ships now under construction in all parts of the country come to a total of 1,123,500 tons.

Assuming the available ways will each produce two pro-standard-ships per year, would turn out about 2,300,000 dead weight tonnage of wooden ships every year. Now when we entered the war 37 steel ship yards were partly steel shipbuilding ways were partly engaged on commercial work and partly on Naval vessels. Under the circumstances the output of merchant tonnage had averaged about 500,000 dead weight tonnage per year for the last 16 years. With 6,000,000 tons to build the problem was plain; build new shipyards, enlarge old, educate new shipbuilders, create new engine, boiler, and turbine manufacturing plants and provide new facilities to manufacture the thousands of various items that go to make a ship in all its myriads of parts.

The 37 yards have now increased their shipbuilding ways from 162 to 195. Either built or in course of construction there are 30 new steel shipyards with a total of 203 shipbuilding ways aggregating 67 steel shipyards with a total of 398 building ways. Thirty-five yards with 258 ways are on the Atlantic and Gulf Coasts—19 with 66 ways on the Pacific, 13 with 74 ways on the Great Lakes.

With the new yards completed and their organization perfected, these 67 steel yards should turn out 7,000,000 deadweight tonnage of steel merchant ships per year. Adding the expected wooden ship tonnage gives a grand total of 9,300,000 deadweight tonnage yearly capacity when the yards now 70 per cent completed are finished, independent of the ways now in use for the Navy in these yards, which would add another 650,000 deadweight tonnage to these figures.

The labor problem has figured largely in the plans to create this industry. In 1916 there were less than 45,000 men in all the shipyards. On March 2d, 1918, this number had increased to 236,000; 170,589 on actual ship construction, the others on yard construction, etc.

To build this enormous tonnage (an increase from 500,000 average to almost 10,000,000 in two years) between 450,000 and 500,000 men will be needed.

On January 28th a drive to enroll 250,000 skilled mechanics in the U. S. Shipyard Volunteers was started. Men from every line of industry who could develop into good shipworkers were wanted; within one month's time the enrollment was practically complete.

The U. S. Shipyard Volunteers is a reserve organization of skilled mechanics, who have placed the welfare of the Nation above all else and stand ready to go to the shipyards when called.

With the coöperation of the international labor unions, a far-reaching scheme of industrial education has been put in operation. At an instruction training center at Newport News 247 skilled mechanics, selected from 22 yards, have been detailed for a six weeks' course of intensive training, to fit them as instructors for recruits brought into the shipyards. One hundred and fifteen of these, representing 16 trades, have completed the course and been sent out as instructors. The men who are taking this instruction course will be capable of training an industrial army of 37,000 men.

Few people recognize either the magnitude of the ship building task, or the work so far accomplished. A single comparison may show a little of both. The Hog Island shipyard with 50 ways building 8,000 ton ships, when it is organized and running to its maximum capacity, will turn out in one year 55 per cent of the greatest amount of tonnage which Great Britain has ever turned out in any single year. Her maximum output was in 1913, when she built 688 merchant vessels—representing 2,898,229 deadweight tons. Hog Island, when running at full capacity should turn out 1,600,000 deadweight tons a year from materials fabricated in different parts of the country, brought into the yard on freight cars, and run to the ways and then put together.

What all the yards may do will not carry a single grain of wheat now. But yards are delivering ships at the present time. In January 11 steel vessels with a dead-weight tonnage of 91,441 were delivered, in February, 16 vessels with a dead weight tonnage of 123,100. Ten vessels with a tonnage of 82,300 have been delivered in March, and 14 other ships, bringing the March delivery up to 197,075 tons, should follow.

The program could not be met without resort to the "fabricated" or more properly the assembled ship, of which 440 are proposed or under construction. The greater part of the work of riveting the plates and steel bars for assembled ships is being done in bridge-building shops, spread all over the country from Omaha east. In some cases 95 per cent of the work will be fabricated

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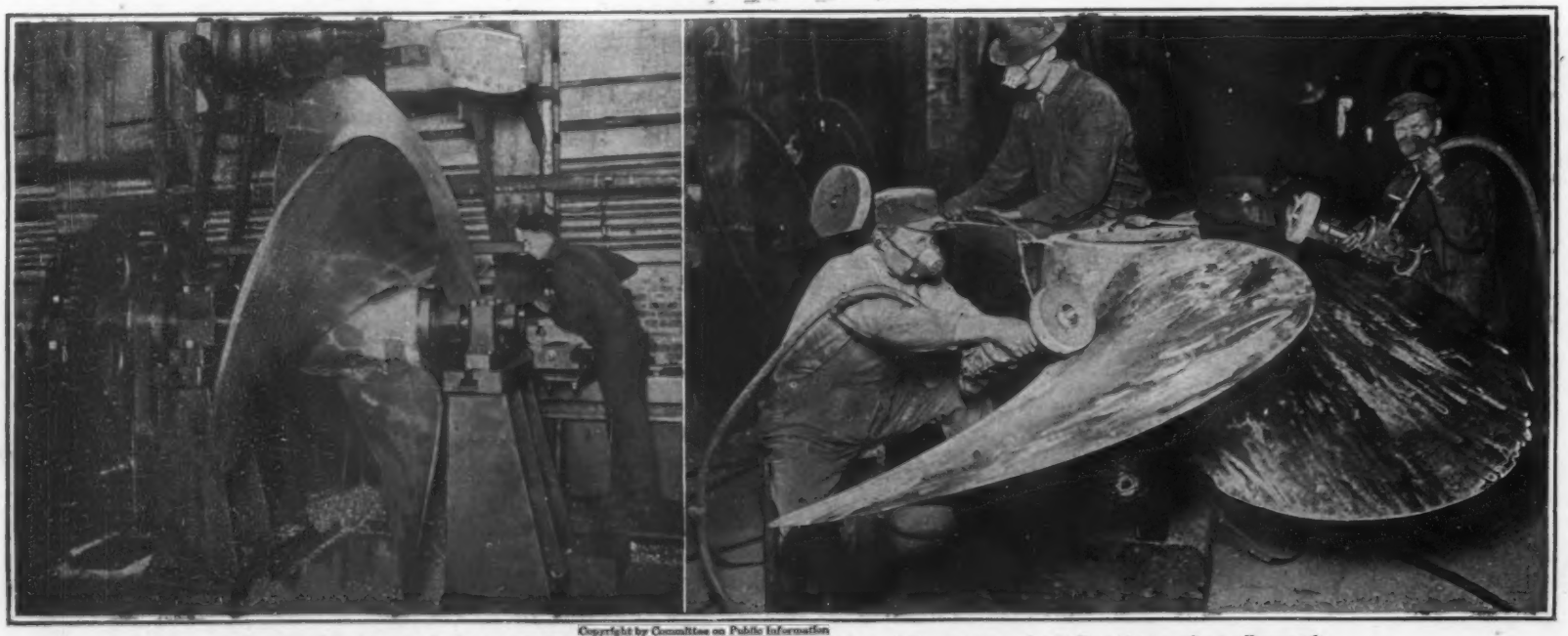
In the mold loft: Laying out the lines of a ship



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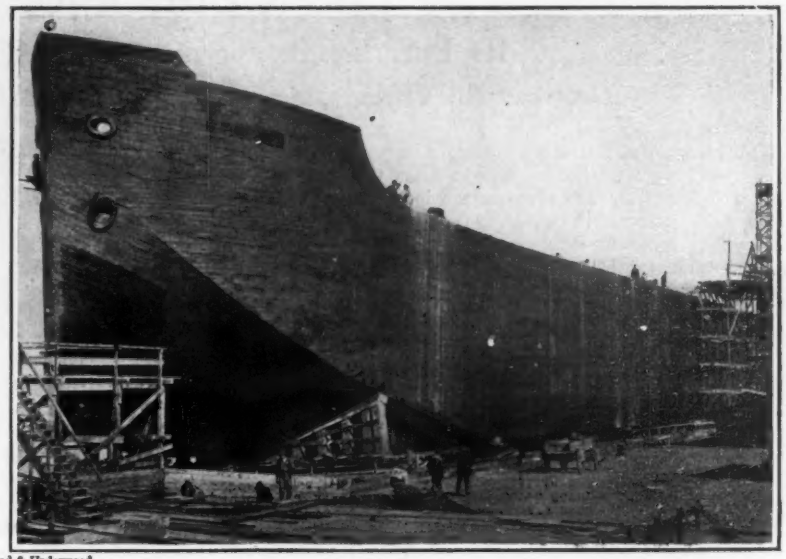
The machine for cutting a true helical surface on the propeller blade, and the process of grinding that surface off smooth

Deck view of the 320-foot concrete ship "Faith"



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The "Faith," the 7,900-ton concrete ship recently launched in California

before it reaches the shipyard. This adds enormously to the actual shipbuilding forces, and makes possible the production of the above shipbuilding tonnage.

The situation giving most concern is the completion of turbines and engines. The very rapid expansion of the shipbuilding program caught the turbine and engine manufacturers unprepared. Special tools of all kinds are required for engine-builders shops, and these tools must be secured from manufacturers already overcrowded with war orders. The severe weather and the transportation tie-up seriously delayed the construction of some large turbine-building plants, causing a delay for lack of the turbines and engines which, however, it is expected will be made up later.

As to labor, I am opposed to its conscription. I believe labor will itself produce conditions which will render idle all talk of conscripting workmen. The vast majority of our workmen are men of intelligence, and when they come to a full realization of the fact that any defection on their part now will not only imperil the Nation, but will injure their brother workers in almost every other field, I feel assured they will respond to all demands made upon them.

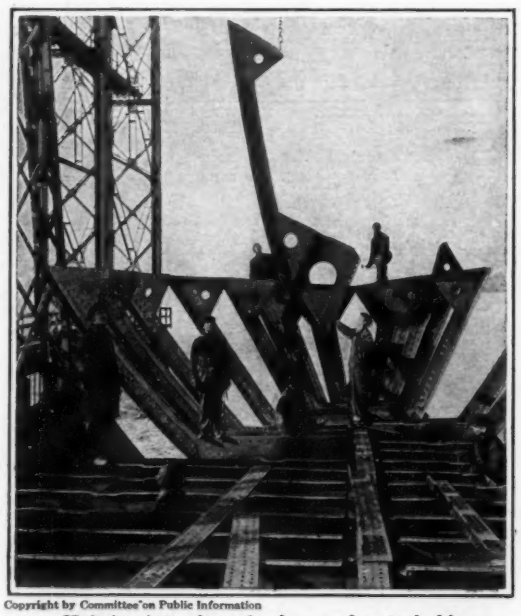
I do not anticipate any trouble on account of strikes. Most strikes have primarily been caused by a feeling on the part of workmen that they are underpaid while owners and contractors have been largely profiting by their sweat. But working for Uncle Sam is a different matter; he is not trying to make anything out of labor, and, moreover, they are now working for their own well-being and National Safety.

Shipping is the essence of the struggle in which the world is now engaged—the keystone of the arch. If it fails, all else fails. The Shipping Board is keenly alive to that responsibility. It is for press and public to help now, and the best way to help—until we can get into our stride—is to let us alone. The Shipping Board is very busy—so busy that emblazoned on its banner is the admonition of Dr. Jewett—"Don't apologize, don't explain; let 'em holler, GET IT DONE!"

Telegraphing Through the Ground at the Front

AN interesting account is published in *Le Matin* by M. Charles Nordmann, a well-known scientist, concerning the use of the induction system of telegraphy through the earth by the armies. His account is prepared from instructions used in the German army which fell into the hands of the French, so that no secrets are divulged, especially in his non-technical exposition of the methods, it being understood, however, that the use of the earth system is not limited to the army in question.

At a certain point on the fighting line is laid a wire of forty to fifty feet, or more, with a ground connection at each end of this wire so as to form a closed circuit through



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Hoisting into place the frame of a steel ship

the earth. A current with rapid interruptions is sent through the wire, for instance from an induction coil, using a telegraph key in the circuit. A corresponding wire is laid on the ground at some distance in the rear of the first, also with ground connection and closed circuit, so that this second circuit has currents induced in it by the first one.

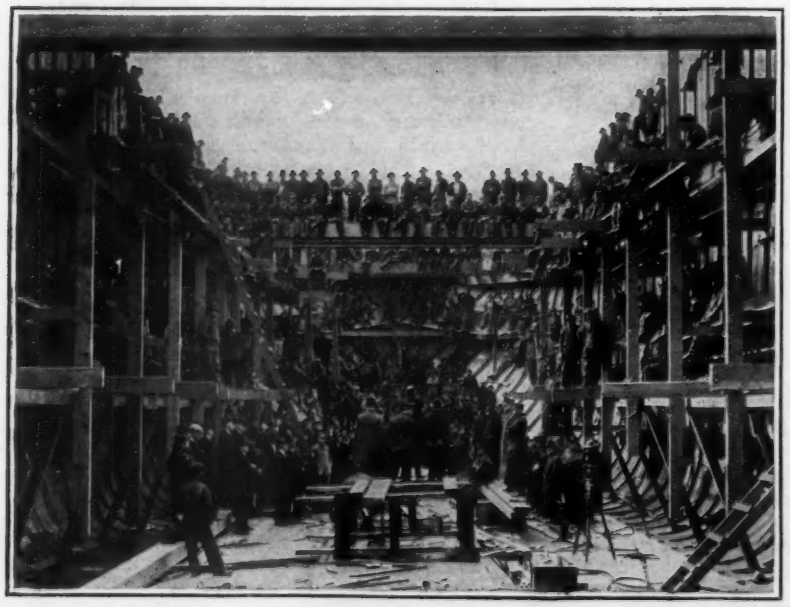
It is proved by experiment that the induction effect takes place expecially through the ground, and for this reason the method is known as "ground telegraphy." The nature of the soil has a considerable influence upon the inductive effect, and a somewhat damp ground which is a good electric conductor will allow of covering longer distances. Thus it is found that wooded ground, which is very unfavorable for the use of masts for wireless telegraphy, is excellent for the earth system, and hence these two methods can be used very well in connection with each other. At the receiving station, the Morse signals are heard in a telephone which is connected in the above-mentioned ground circuit, and the sound can also be increased by the use of suitable means. Of course, the same pair of circuits can be used for sending or receiving, that is, a key or a telephone can be switched in at either station.

The ground telegraphy method not only serves for direct messages, but on both sides efforts are made to tap off telephone conversation made by the enemy. The current in the enemy telephone lines at the front produces induced currents in the ground which can be tapped off by the wires of the ground telegraph when these are laid concealed in the trenches. In fact, it is found necessary to avoid this, and ordinary language is never employed in telephone conversation in the advanced lines of the front, but all important names such as batteries or places are specified by numbers or other conventional words.

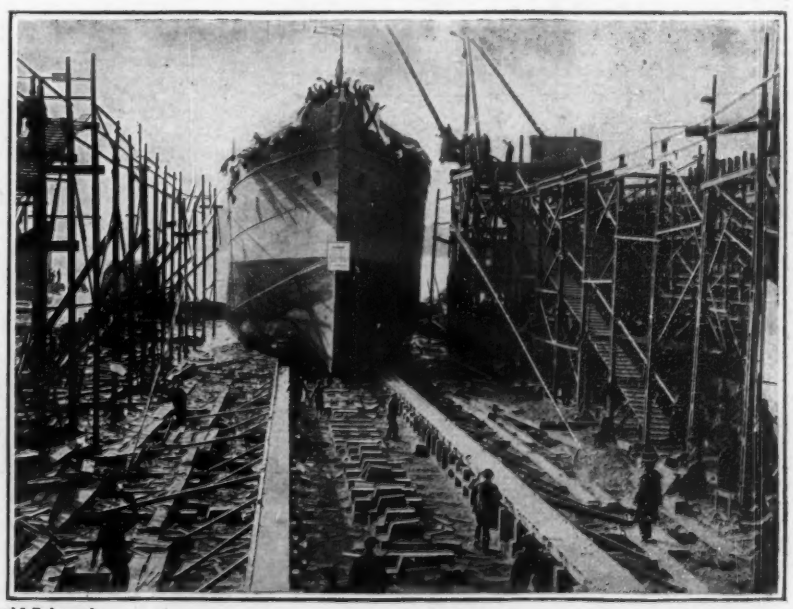
One point which the author (an astronomer of the Paris Observatory) brings out is that natural earth currents have a great effect upon the induction through the ground, and can often entirely prevent the system from working.

Making Bread of Peanut Flour

A BAKING company in Gainesville, Fla., working in coöperation with B. F. Williamson, a chemist of that city, has put peanut bread upon the market, and is securing wide distribution for it in that locality. The peanut flour used is made from peanut cake left after oil extraction. It contains a satisfactory percentage of fat and is said to have almost twice the nitrogenous food value of dried beef—44 per cent for peanut flour against 25 per cent for dried beef. One-fifth peanut flour to four-fifths wheat flour produces a balanced ration, supplying necessary ingredients furnished by bread and meat in human diet.



A patriotic rally in the hull of one of the new wooden ships



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Launch of the "Coyote," first of the wooden ships on the Atlantic coast

The Council of National Defense

Its Purpose, Its Significance, and Its Contribution to the Great War

By Grosvenor B. Clarkson, Secretary of the Council of National Defense and of the Advisory Commission

THE Council of National Defense, in its present form, was born almost overnight to meet the nation's need. Created by act of Congress in August, 1916, it was then designed to be a body for peacetime effort—an agency primarily for the coördination of industries and resources for the national security and welfare before war should come upon the land. It would seem, however, that the authors of the enabling act had almost an inspirational insight into what was to be America's task, for when we finally entered the great war the embryo organization of the Council constituted the only available mechanism whereby on a large scale to rally and to utilize the industrial, engineering, and scientific genius of the country for the Union's defense.

The Council, its Advisory Commission, and their subordinate bodies were not permanently organized until early in March, 1917. At no time has the Council had mandatory power in carrying out its purpose, yet after 12 months of war it has, almost solely through its initial vision of seizing upon and translating into action the theory of voluntary coöperation, become a unique body in governmental affairs and put behind it a volume of pioneer and fruitful work probably not to be equalled in the history of federal administration. That is a pretty strong statement, but let us consider the facts.

The Call to Industry

The Council has made three chief contributions to America's part in the war. By summoning to Washington upon our entrance into the arena the unquestioned leaders of industry, engineering, and science, and putting these men to work with no other persuasion than that of the most poignant of appeals, love of country, it opened new paths along which government and industry have come to a better understanding each of the other, and encouraged those eminent in industrial and professional life to bend their energies to the common effort.

Secondly, through the priceless principle of voluntary coöperation, the Council has very largely eliminated profiteering in connection with the war making of the United States; and in doing so has undoubtedly raised a higher standard both of industry and of government. Julius Rosenwald, the great merchant of Chicago who sits in the Advisory Commission of the Council and under whose direction the government has most efficiently purchased $800,000,000 worth of supplies for its armies, said to the writer not long ago that he knew of no sacrifice or coöperation that had been asked of American industry that had not been cheerfully met. It is this same principle which has made it possible for one division alone of the Council, that of raw materials, minerals and metals, under Bernard M. Baruch of the Advisory Commission, to save to the nation well over a billion dollars through the reduction of prices on iron and steel as against the pre-war prices for those commodities. It is almost elementary that such coöperation should bring a new philosophy into American governmental affairs, and make all of us realize anew that the American nation, properly appealed to and justly dealt with, is simply a partnership of 100,000,000 persons seeking, sometimes blindly, sometimes with human irritation, sometimes with undue sentimentality, but still always fundamentally seeking, to fuse their interests, material and spiritual, into a national unity.

Thirdly, the Council has performed an almost invaluable function in acting as a sort of official incubator for new ideas necessary to win a war under modern conditions. Few people realize to what an extent the Council has either conceived or adopted such ideas, passed them through the crucible of investigation and research, vitalized them with the touch of organization, and moved them on to one or another of the executive departments of the government. Witness, among other instances, the Aircraft Production Board, the Committee on Coal Production, and the Industrial Service Section. The Council created these vital bodies, and then allowed them, or the fruit of their labors, to be allocated to th ir proper and permanent abiding places in the government.

A National Clearing House

Particularly when war comes to a democracy in these days with all the tremendous organizing ability which modern conflict relentlessly demands of nations, there must be a head center as well as a central germinating point for the conception and analysis of the ideas and needs brought forward by the hour—a clearing house of national problems, if you please. Through the irresistible force of circumstances the Council has been made this common focus. The extent to which the truth of this, consciously or unconsciously, has sunk into the imagination of the country may be gained by a perusal of the thousands of newspaper and magazine editorials on the work of the Council which are on file in its offices and which show a tacit or affirmative realization of the role that the Council has played in the nation's life during the epic twelve months through which we have just lived.

All of this has made it necessary for the Council of National Defense to hold itself essentially a flexible organization. War today is primarily a conflict of the mechanic and the machine and the direction of the vast and delicate mechanism of American industry demands great administrative elasticity. The Council is and can be in no sense a fixed institution, but must continue its evolution swiftly enough to move parallel with the current of the times and yet with equal wisdom must maintain a conservatism sufficient to avoid lack of correlation and the cohesion of purpose and action synonymous with sane and scientific government.

What part the Council will play in the reconstruction problems ensuing after the war, no one can tell; but it is very reasonable to assume that all of the experience that the Council has gained in touching the life of the country intimately at almost every point cannot be disregarded when this new task is thrust before us. There has been accumulated under the Council a fresh knowledge of American life and its potentialities that it would be almost criminal not to apply in considering the post-war problems of the Republic.

Before leaving the more academic consideration of the Council, I shall quote the following from the pen of Newton D. Baker, Secretary of War, who has been Chairman of the Council of National Defense since its inception: "Whatever determination Congress may hereafter reach with regard to the bestowal of additional

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Grosvenor B. Clarkson
Secretary of the Council of National Defense and of the Advisory Commission

executive power and the creation of agencies for its exercise, the advisory function of the Council of National Defense ought not to be impaired, nor ought its usefulness to be left unrecognized. In the first place, the Council brings together the heads of the departments ordinarily concerned in the industrial and commercial problems which affect the national defense and undoubtedly prevents duplications of work and overlappings of jurisdiction. It also makes available for the special problems of individual departments the results attained in other departments which have been called upon to examine the same problem from other points of view. In the second place, the Council supplements the activities of the Cabinet under the direction of the President by bringing together in a committee, as it were, members of the Cabinet for the consideration of problems which, when maturely studied, can be presented for the President's judgment."

Visualizing the Problem

On March 1st, 1917, the Council and Advisory Commission had three rooms in an office building in Washington. Today the Council and its subordinate bodies, including the War Industries Board, are housed in one building (put up in 49 days by one of its own committees), containing some four hundred rooms and in two other houses in the city. The rapid expansion of the Council's organization during the first six months of the war was such that in this period the writer was forced eight times to move his own office in the same building. During this period when engagements were made indifferently at midnight or at noon, the organization of Monday necessarily was not the organization of Friday—and in this unavoidable condition of affairs may probably be found the impression of confusion gained by outsiders whose minds lent themselves more to complaint than to analysis of what we had to contend with. People do not realize, for instance, that when war broke there was one colonel with four assistants to build the cantonments. The largest year's work on the Panama Canal was $46,000,000; the lone colonel and his four men were faced with the job of expending $150,000,000 efficiently and honestly within three or four months. Incidentally, the consummation of this task was made possible by the action of the Council of National Defense, through the agency of Major W. A. Starrett, in building an organization almost overnight around Colonel Littell and summoning to Washington by telegraph and telephone the leading contractors of the country. It may be said, finally, that the job as completed has proved to be one of the greatest engineering accomplishments of all time and was done at an average profit of only about three per cent to each contractor. This, merely by way of visualization of the riddles to be solved by a peaceful and complacent republic plunged precipitously into a terrible war.

The Fruit of the Work

To date, the accomplishments of the Council of National Defense, its Advisory Commission, and the subordinate agencies under both bodies, may be sketched as follows:

The procurement of raw materials for the use of the military and naval forces of the United States at prices greatly below the current market price, this being made possible by enlisting the patriotic coöperation of industrial leaders. The iron and steel savings, as has been said before, run to over a billion dollars.

In the case of copper the first purchase of 45,000,000 pounds at a price of approximately one-half the market price saved from 15 cents to 20 cents a pound, or from $6,750,000 to $9,000,000.

In view of the shortage of copper it is conservative to say that no less than 10 cents a pound and possibly considerably more has been saved by the later price of 23 cents established by the War Industries Board for the Government, the Allies, and the public alike.

Lead was obtained at 8 cents a pound when the market price was in the neighborhood of 11 cents to 11½ cents, a saving of $1,500,000 to $2,000,000 on the Government's requirements.

Two hundred thousand dollars has been saved on the purchase of more than one million barrels of cement at a saving of 20 cents to 30 cents a barrel.

Grain alcohol has been purchased at 68 cents while the market price is from $1.15 to $1.20. On a total amount of 2,000,000 gallons, which represents approximately the Government's requirements to date, the saving would be $940,000. On wood alcohol, the entire supply of which has been purchased by the Government, the priced fixed was 80 cents while the market price was $1.45. On the same amount the saving would be $1,300,000.

Timbers for the Ships

On lumber, through negotiation with the manufacturers and the establishment of a coöperative bureau distributing system, the committee in charge established a price of $35 per thousand for ship timbers—timbers of such unusual size that only the largest and best equipped mills could produce them. One hundred schedules for one hundred ships were then distributed among the mills, and within thirty days the shipbuilders were paying $10 to $15 per thousand more for common timbers for shipways than they were paying for the special timbers on which a price had been arranged by the committee. The evidence of the market price movement indicates a saving on 140,000,000 feet of these timbers at $20 a thousand of $2,800,000.

By change in specifications of lumber sash and doors to agree with standard market sizes a saving of more than $5 a thousand feet was effected in cantonment lumber which would amount in all to about $4,000,000.

On cantonment lumber the saving through esta lishing maximum prices has been estimated conservatively on the whole job at $10 per thousand, a total of about $8,000,000. The elimination of the profits of middlemen unquestionably resulted in a saving of $2 per thousand, or about $1,600,000.

On the planning for the cantonments it has been variously estimated that from $500,000 to $1,000,000 on each National Army cantonment and $300,000 on each National Guard cantonment was saved by the work of the Emergency Construction Committee of the Council

(Continued on page 322)

The Fuel Question

Readjustment of a Great Industry to the Drastic Demands of War

By H. A. Garfield, Fuel Administrator

THE purposes of the Fuel Administration as expressed in the Act of Congress authorizing its creation, were to assure an adequate supply and equitable distribution of fuel, and to establish and maintain governmental control of the same during the war.

The selection of a Fuel Administrator was made by the President, on the 23d day of August of last year.

At that time the coal industry was in a state of great confusion, and had been for many months preceding. The demand for coal was greater, perhaps, than at any time in the history of the industry. The increased demand had come from factories and railroads, in the main. Public utilities plants likewise had increased requirements. At that time the need of fuel for domestic purposes, was normal; the urgent need of fuel for household requirements was a later development, but one which gave to the Fuel Administration most serious concern.

The vastly increased demands for coal taxed the capacity of the railroads to transport the product to the markets. The railroads had been overwhelmed by an increase of traffic, due to the war, of which coal constituted perhaps one-half in the number of cars used. Coal had, therefore, become the chief factor in clogging the railroads. Coal cars, instead of moving in orderly fashion, to and fro, were jamming the sidetracks at divisional points and terminals, and blocking trasnportation on the main lines.

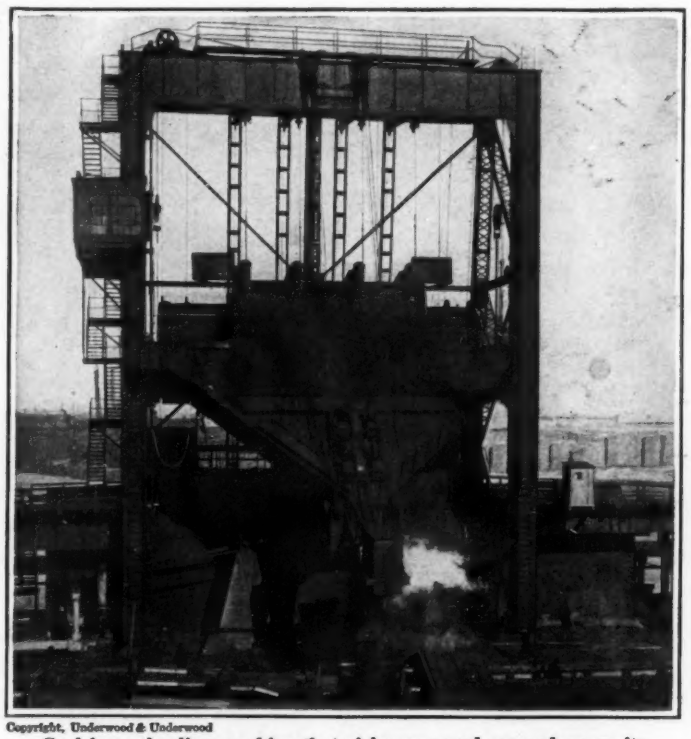
This situation had two direct effects upon the business. It sent coal prices up and dropped production back to a sub-normal status. The mines could not produce except as cars were furnished. Consumers depending on the restricted tonnage issuing from the mines, by the pressure of necessity for fuel, put upon coal the abnormally high prices prevailing at the time of the President's order fixing prices.

Not only was the Fuel Administration hampered at the outset by railroad difficulties, but in addition, found it necessary to devote a great part of its time to the solution of other problems confronting it. For the first three months the time was largely taken up in reconciling differences that had arisen between operators and mine workers. Strikes in various of the coal fields effected a loss of production amounting to 20,166,442 tons of bituminous coal during the period August 18th to November 24th. An agreement was reached between the miners and operators, sitting with representatives of the Fuel Administration, in Washington, on October 6th, which agreement was later ratified by the United Mine Workers' convention. While delays were occasioned in production on account of these wage controversies, it is a matter of gratification to testify to the very loyal response of both operators and miners, and the faithfulness with which both have respected the Washington agreement.

It also became the duty of the Fuel Administration to continue the investigation of the cost of production. To do this a force of experts and clerks have been employed constantly since the Fuel Administration begun its activities. The prices fixed by the President were provisional, as he stated when his order was promulgated. The way was left open for readjustments by the Fuel Administrator as occasion required.

Almost instantly tests from came pro- from prac- every coal ducers tically the prices field, against made effec- by the President's tive by the order. Hun- have come dreds of cases tion and in under examina- mine prices have many of them the The Administra- been increased. policy of allowing a tion has held to the liberal profit to the coal producer as the best means of stimulating production. The rule that has been kept in mind in rearranging prices has been to preserve a uniformity of price to the consumer, if possible; diversity of price to the producer as far as may be necessary and warranted to secure the production.

In dealing with prices as well as all other subjects having a permanent bearing upon the coal industry the Fuel Administration has endeavored to be guided by two fundamental considerations: the effect of its order on the industry in case the government should permanently retain control of coal production; and, the effect, should the government surrender control at the end of the war. To find an adjustment of present, war time exigencies suitable to both of these contingencies has had its difficulties, but so far as has been possible, respect has been paid to them.



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Coal-barge loading machine that picks up a coal car and pours its load into a barge

At the outset of the governmental administration of the fuel supply, attention was paid chiefly to the provision of an adequate supply of coal to that section of the country dependent on lake transportation; to the requirements of the government for its own uses and to supplying the industries engaged in war work. By custom, the lake shipments cease about the middle of October. But, owing to the difficulties attending railroad transportation, the season was extended so that the requirements of the northwest territory might be met.

A division of the Fuel Administration was created, the business of which was to divide as equitably as possible the coal that came out of the various fields, to meet public demands. While at first its attention was confined to the distribution of coal for government purposes and to supplying plants manufacturing war products for the government and our Allies, new and arduous tasks were added with the advent of the winter season. The time came when it was necessary to consider the domestic consumer even before the government. The country has passed through the most severe winter of record for 50 years. From the first week of December until well along into February, the demands for coal for domestic purposes were unprecedented. In many of the cities consumers were compelled to rely upon a day-today supply. At times, in many places the supply was entirely exhausted. The call for coal to keep the houses warm was expressed in hundreds of telegrams of appeal received daily by the Fuel Administration. Not only did the severe temperature operate to swell the requirements of the people but it also reduced the limited ability of the railroads to move the product. Water transportation, depended upon by consumers in New England, was, at times, entirely closed. To meet urgent demands, coal in transit was, from time to time, diverted on order of the Fuel Administration.

During the Spring of 1917, several months prior to the passage of the Lever Bill and the appointment of the Fuel Administrator, consumers were advised not to buy coal on the assumption, apparently, that prices would be lower. Whatever may have been the justification for this advice at the time it was given, conditions prevailing at the end of August required a different treatment and a different answer was given to the question shortly after the Fuel Administration was set up. The advice then given and consistently adhered to was, "Buy all the coal you need but do not go into the market and add to the transportation difficulties. Buy what you need, but do not buy in excess of your needs. I believe that the price will come down, but at any rate, it will be steady or stabilized. The stabilizing of the price is about all that we can hope for."

Conservation measures were planned and promulgated, with the view of spreading the field of requirements. In all of the plans of the Administration there was an unanimous and patriotic response on the part of the people. Too much cannot be said in praise of the patience, fortitude and loyalty of the American people in meeting their obligations to the government. Nor, should credit be withheld from the mine workers and railroad officials and employees who sought to relieve the suffering imposed by cold weather.

The measure applied by the Fuel Administration to

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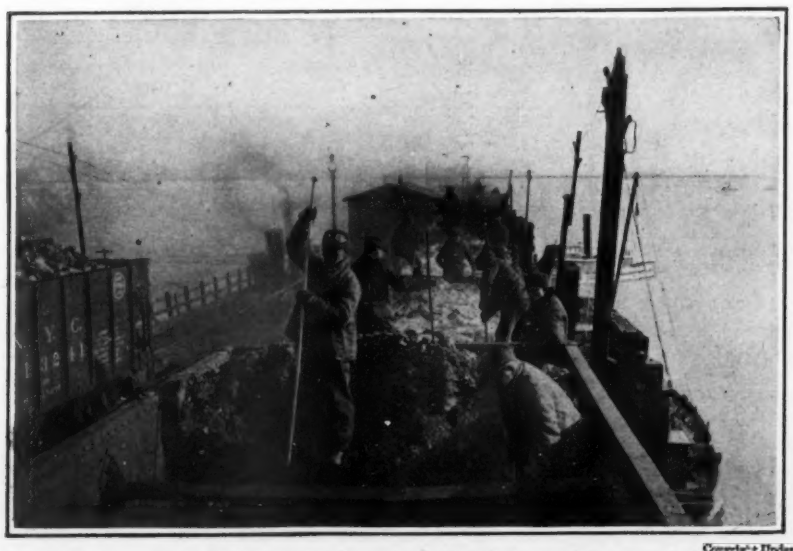

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Digging out the coal frozen in the cars, during the recent severe weather

Hammering the sides of the car to dislodge frozen coal

Motor Trucks in the Great War

The Whole Face of Modern Warfare Changed by these Traction Giants

By H. L. Horning, Chairman of the Automotive Products Section of the Council of National Defense

WAR consists of a series of operations in which great pressure is brought to bear upon a given point. Success depends upon the force, and upon the speed, the promptness and the intelligence with which it is applied. For open warfare, Napoleon's Ninth Maxim makes this clear. "The strength of an army, like the power in mechanics, is estimated as the product of the mass by the velocity; a rapid march augments the morale of an army, and increases the means of victory. Press on!" Stonewall Jackson, too, laid down certain principles which illustrate the value of speed and action in open warfare. "To move swiftly, strike vigorously, and secure all the fruits of victory, is the secret of a successful war."

Great conflicts swing from failure to success on speed of action. Mobility is the chief strategy of modern arms. Prompt and timely blows bring victory. A military critic has written: "One can almost say with certainty that every defeat in the Civil War happened because someone was slow, or stopped to rest, or marched too slowly, or halted for someone to join him, or waited for an order. Precision is the hall-mark of modern warfare. Motor transportation has made possible a promptness and a speed of attack never before possible."

The Motor Truck in the First Two Years

In the spring of 1914 the Mercedes Company in Germany called in all cars and, taking advantage of the holes which marred the frames in their models for some years back, so strengthened them that they could be quickly converted into war trucks. In the late winter of the same year a well known American engineer visited the Mercedes factory and saw large rooms completely filled with truck cylinders—enough for a year's production. Such were some of the German preparations for the great war.

The Allies entered the war with subsidized models in comparatively small numbers. The British had a limited specification covering war trucks and the tests required of them. In France the same conditions obtained. In Russia there were trucks of every country and many makes. Germany's better preparation, on the other hand, made use of few types of vehicle. It may indeed be said that only the indomitable spirit of Belgian, French and British resistance and sacrifice held back one of the most effectively planned drives in all history.

When the English and French armies retreated from the north to the east of Paris they exercised the attractive force which von der Goltz states a defending army will exert on the invader, giving the French in Paris the opportunity to collect and employ the famous taxicab army to the west of the city. Motor vehicles of all kinds were used, trucks, chassis, charabancs, private cars, taxicabs; and the Germans were outflanked in the Battle of the Marne. Posterity will write down this victory for mankind as the first notable military use of the motor vehicle.

In the campaigns of 1915-1917 the Russian success which at times seemed so certain was headed off by the superior mobility of the German army, where comparatively few men turned the tide of the Russian invasion. During the last campaigns of Brusiloff and Korniloff, the spy system of Germany made the superior mobility of the Teuton forces completely effective by means of railroads and trucks—the German reinforcements arrived at the point of attack three hours before the Russian charge.

Motor transport has made it possible to carry on an unprecedented intensity of fire, such as occurred for days upon days in the second Battle of the Somme—where a ton and a half of projectiles were hurled against each meter of line every day. Adding to this volume of ammunition the miscellaneous supplies necessary to keep the trench army going, it is easy to realize that in trench warfare as well as in open campaigning motor transport has changed all modes of fighting.

Motor transport systems made it possible to offset the advantage of interior lines; and, under proper control, they have become the mainstay of the Allies in their unfavored position. In the battle of Verdun, the first intense fire of the Germans destroyed the railroad communications; and from then on, motor trucks saved the French in the greatest battle of history, American trucks playing no small part in the final result.

Clearing the Boston Post Road with a snow plow to keep the highway open for heavy traffic

The motor truck is used effectively both for the transport of supplies and men and for the follow-up in successful attack. It is of great assistance in building up the conquered territory. The rapid execution of engineering works is accomplished by well managed transport service; rapid construction of pontoon bridges, railroads and highways is possible by the aid of powerful motor trucks.

Repairs to lines of communication, construction of fortified positions, the construction and rebuilding of army structures to meet the emergency of the moment, make it possible for the modern army to conduct a successful operation against its slower enemy. In the second Battle of the Somme, the rapid follow-up was the contribution of the motor trucks to a new type of offensive.

Rapid transportation has made it possible to save the lives of many wounded by promptness in reaching the proper place of treatment. The motor truck has contributed to the effectiveness of offensive and defensive operations by rapid handling of strategic reserves and by increasing the usefulness of the effectives. The handling of the modern battle has been molded by the motor truck. The French, in the Battle of Verdun, used their reserves to the limit of efficiency by means of motor transport, and probably doubled the usefulness of the effectives available.

A Fund of Experience for Uncle Sam to Draw Upon

The Allies started the war with a small amount of information on motor transportation. Necessity made development rapid, but not until the winter of 1915-16 was a system evolved that could be counted on. The United States entered the war with the experience of the Allies at its disposal and with information of value gleaned from its own Mexican campaign. Upon this background of experience and information is based the design of our military truck and the plans for its use. These plans call for more trucks per million men than the combined requirements of Great Britain and France for armies comparable with ours. Comparatively speaking, there is only one place in the service where the use of horses prevents the American Army from claiming complete motorization.

The organization necessary to keep the trucks in service exceeds in complexity that of a great motor-car plant. The base repair shops are the center of a small city, built in a convenient location and arranged with an eye to the purpose for which they are intended.

To appreciate what position motor transport occupies in the war, it must be realized that to supply our army with trucks alone will require double the number of ships we had in 1914. The Quartermaster Department, at the declaration of war, was purchasing the trucks for the army. So great was the demand of the various departments for trucks suiting their various needs, however, that they were given authority to purchase and design their own until such time as standardized models could be brought out.

Three methods were used in accomplishing this end. The Ordnance, the Engineers and the Medical Departments adopted certain commercial models, with such minor changes and improvements as would tend to fit them better for the particular service in view. The Signal Corps developed two very creditable models for its needs by designing trucks to be built from high class parts by a number of truck makers. Finally the Quartermaster Department designed trucks from beginning to end, so completely standardized that the parts could be built in every available parts or truck plant and assembled anywhere.

During the year two four-wheel-drive vehicles have been standardized by the Ordnance Department and there have been developed five temporary standard models of the two-wheel-drive type, with three permanent models, completely new and standardized. No finer example of American enterprise and skill can be shown than the results attained by all the departments in their preparations for furnishing transportation for the army; and it is a credit to all that, notwithstanding,

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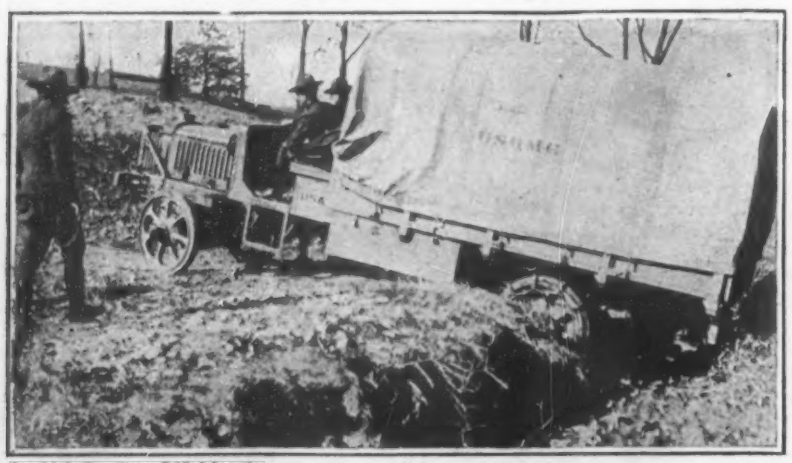

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Putting one of the Liberty trucks to a severe test

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Experiences like this at home will fit our drivers for rough work abroad

The German Long-Range Gun

A Development of Long-Established Principles of Design

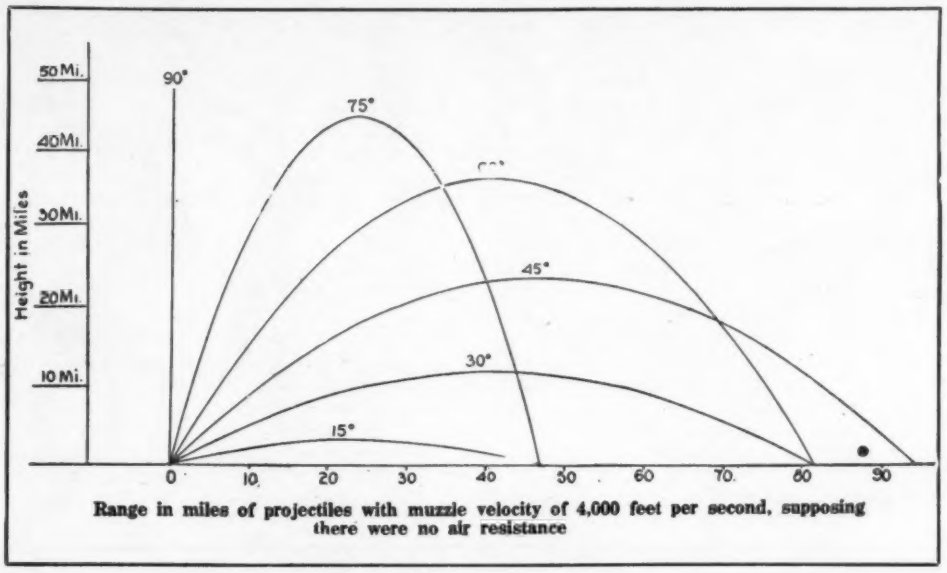
THE German long-range gun, which is bombarding Paris, has a value more spectacular than military. The principles that govern the construction of such a gun have been familiar to artillerists, and the materials for its construction have been available, for many years past. The Allies have not built any such gun for the reason that there was no military use to which it could be put. Furthermore, its unwieldy length and weight, its great cost and its very limited life, due to erosion, have been recognized as rendering it, when built, an impracticable weapon under the existing conditions of warfare, either on land or sea.

The construction of an enormously costly gun, such as this, can be justified only if it is highly efficient; and a gun that shoots so far that it is impossible to plot the fall of the shots is so inefficient as to be practically valueless. No airplane would be allowed to circle over Paris for observation, and if it could do so, its wireless would not carry to the gun.

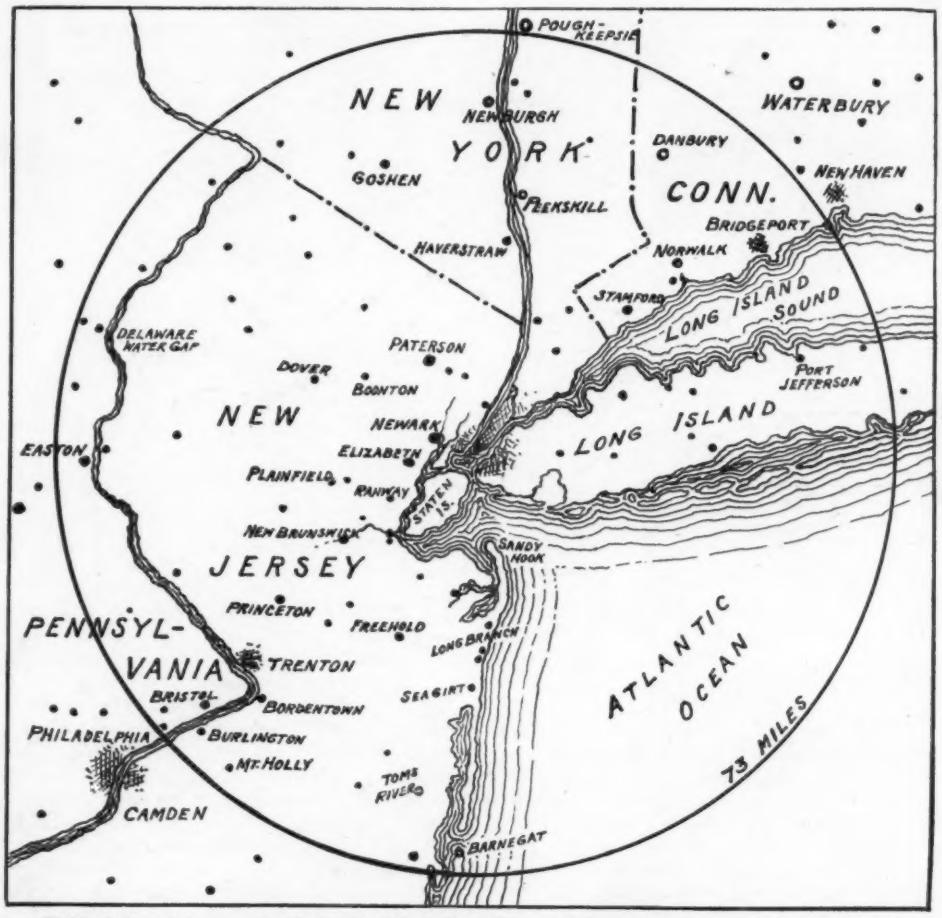
The feat of throwing a shell over 70 miles is unprecedented and sensational; but the design and construction of such a gun does not call for any radical change in the theories, materials, or practice of gun construction. If we could visit the emplacement, we should find there, probably, a built-up, rifled, steel, 9½-inch gun, that differed from the ordinary high-powered, high-velocity gun only in the great size of its powder chamber and in the great length of the bore.

The Allied nations could have built such a gun, built a dozen of them, if they had wished to do so. But seeing that they are in this war to smash Prussia, and not to play to the gallery, or to do circus tricks, and certainly not to practice frightfulness, they have been content to build guns that would hit their military objectives up to the limit of distance at which observation of the target is practicable.

So far as the gun is concerned, the distance to which a shell of given caliber and weight can be thrown depends upon the velocity with which it leaves the muzzle of the gun; and the muzzle velocity depends upon the size of the powder charge, the mean pressure of the powder gases upon the base of the shell, and the time during which this pressure is exerted; which last condition depends on the length of the bore.



Range in miles of projectiles with muzzle velocity of 4,000 feet per second, supposing there were no air resistance



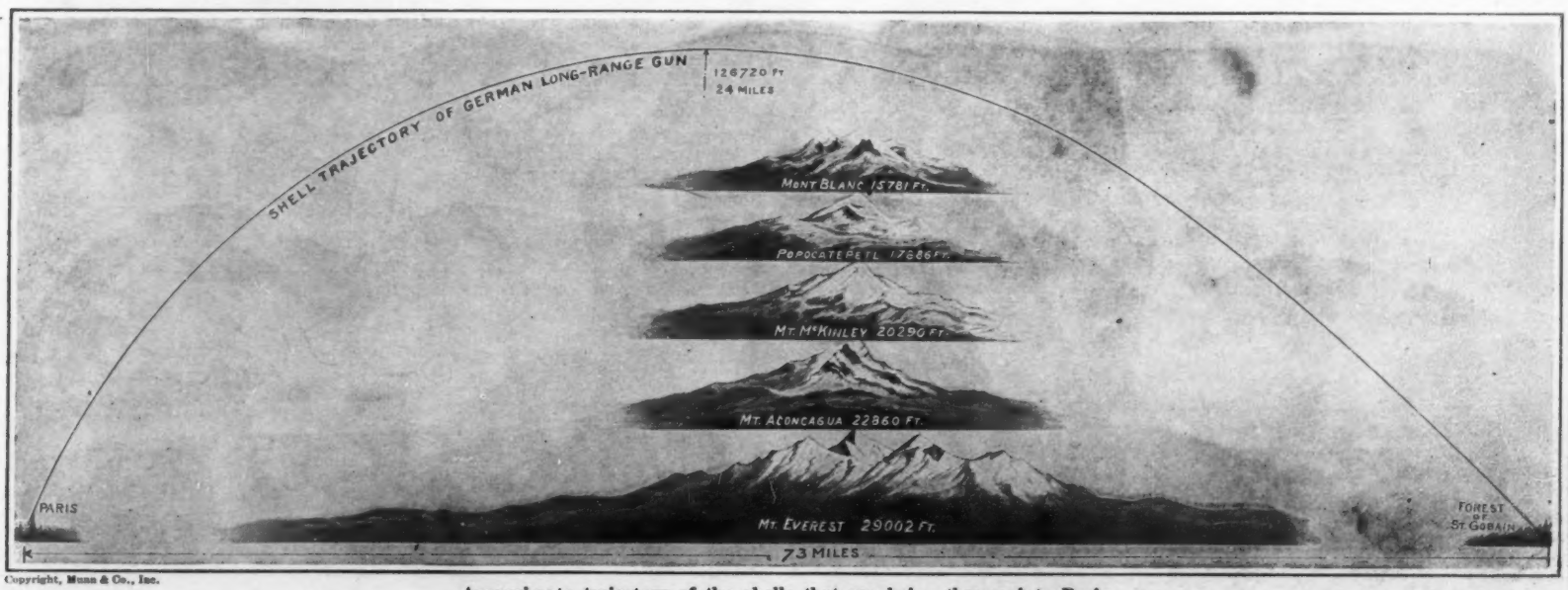
Field of fire of the gun that is bombarding Paris, if it could be traversed. There is reason to believe the gun is fixed and has only one line of fire

So that when the German or Austrian artillerist, or whoever it was, had decided to use a 9½-inch shell, all he had to do was to select his powder, and then design a 9½-inch gun with an unusually big powder chamber and a sufficiently long barrel to secure a sufficiently high muzzle velocity to carry the shell to Paris, a distance of over 70 miles.

The construction of the gun would not present any special difficulty, except that the great length and weight of the barrel would cause it to sag or droop at the muzzle. To prevent this, the gun has either been stiffened by a vertical truss, or (and this is more likely) it is mounted for its full length upon the sloping face of a concrete base, inclined at 43½ degrees—the angle of elevation which gives the greatest range. In this case, the gun can neither be elevated nor traversed—and, theoretically, the shots should fall, practically, in the same spot. This, according to dispatches is exactly what is happening—the dispersion of the shots being due to varying atmospheric conditions, and not to intelligent aiming of the gun.

It is an odd coincidence that, two weeks before this gun made its appearance, we should have drawn attention in the SCIENTIFIC AMERICAN to the fact that, 20 years ago, a wire-wound gun was designed, whose maximum range, as calculated by Colonel Ingalls, our greatest authority on ballistic, was about fifty miles. Now, that gun was only 45 calibers, or 38 feet in length, and its powder chamber, though larger than usual was not abnormally large. Its powder pressure was higher than is allowed in our Army and Navy guns. The heat of the powder gases, due to the high pressure necessary to secure 4,000 foot-seconds velocity was so great, that the rifling would have been burned out of the gun in a very few rounds. In firing tests of a previous 5-inch gun of the Brown type, the powder charge was increased until a muzzle velocity of 3,850 feet per second was secured; so that there is little doubt that,

(*Concluded on page 332*)



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Approximate trajectory of the shells that are being thrown into Paris

Food for All—A Fundamental War Problem

Results Accomplished During Eight Months of Work in Food Control and Distribution

By The United States Food Commission

IN the case of the Food Administration the end of the first year of the war marks the end of the eighth month of activity as a department of the Government. The Food Control Bill was passed August 10th, 1917. Before that, from the 15th of June, the Food Administration had been operating as a volunteer organization. Our duty was a part of the great task to make America effective for war, even to the last man, the last dollar, and the last item of food.

The Food Administration had to touch all sides of American life, coming into contact with:

Every farmer, cattle raiser, gardener, and producer of food of every type in the country.

Every manufacturer and maker of food commodities.

Every importer, exporter, wholesaler, jobber and dealer in food in large lots.

Every one of the more than 400,000 retail dealers in food in America.

Every one of the citizens of the country gathered together into something like twenty-two million or more families

By its very nature, the food business is closely interrelated with other and large activities that are connected with the well-being of the country and are vital to the successful prosecution of the war against Germany.

And among these are:

The transportation systems of the country.

The financial and banking systems of the country.

The activities of the Allied nations concerned with buying food here and shipping it from our shores:.

The Food Administration had to be ready to deal with these forces not under the normal conditions of peace, where there is time and opportunity for systematic adjustment to new conditions, but under the abnormal conditions of war. As promptness was of the essence of the task it had to act immediately to satisfy the requirements of our own citizens and to serve the needs of our associates in the war.

Moreover the Food Administration had not developed with the growth of these abnormal conditions. It was injected at a late date into a situation which had been changing progressively since the beginning of the world war, and was, as the time of American participation in the conflict approached, rapidly becoming disorganized.

The customary laws of supply and demand were being violated and in some cases set aside. As the demand from here and abroad grew it was reflected in the specter of national and world shortage in food crops. Whether that specter was real or imaginary the result was the same, namely to institute anxiety, with its attendant ills of changes of standards of living on the part of the consumer, disorganization of normal demands, uncertainty and capriciousness of flow in food stocks, and, on the part of the food-dealer, wastage, a relaxation of his systematic methods, and in some cases excess profit-taking, hoarding and speculation.

Allied purchases were making a drain upon the foodstuffs of the country, and under stress of self-protection these purchases were tending to be more and more centralized and to reflect stipulated prices, which were themselves disruptive of the ordinary courses in the food trades.

Rumors of price-fixing were current in the American markets, and this tended further to disorganize conditions. The bill which created the Food Administration actually fixed the price at which 1918 wheat should be bought on behalf of the Government, and this resulted in a necessary adjustment in price of 1917 wheat and was reflected in price readjustments in other food commodities.

A Slice of Bread—it Weighs Only One Ounce, but—
—if Each of the 8,000 Persons Who Enter This Room Today Saves a Slice of Bread, They Can Send to France 16 Sacks of Flour
SAVE THE WHEAT
Some Easy Ways to Save a Slice of Bread a Day
Potatoes
Use Muffins Instead of Toast for Breakfast
Cut the Bread on the Table
Use Wheatless Deserts
Do Not Use Wheat Cereals for Breakfast
Use "Emergency Bread"
Use the Scraps

Save the wheat—some of the ways in which it can be done

The immediate result of these conditions was a rise in the price to the consumer of unexampled promptness and scope. Between April 6th, when the United States officially declared that a condition of war existed with Germany, until May 17th when President Wilson called for the inauguration of a plan for volunteer food administration by the appointment of a Food Administrator, 41 days elapsed. In this period the retail prices of a selected list of 17 of the chief food commodities, including among others white bread, corn meal, rice, potatoes, prunes, sugar, bacon, round steak, milk and cheese, increased 23 per cent. An approximately complete list of food staples shows for this period an increase in retail prices of 20 per cent.

This rate of increase, if unchecked, would have carried prices to heights unparalleled even by wartime prices in the South during the Civil War and would have debauched our whole system for the prosecution of the war. This situation was made particularly difficult in the cases of two primary food commodities of wide use, wheat and sugar, in which the conditions of production, the stress of Allied demands, and the system of management under peace conditions required that the government immediately take charge under conditions of war.

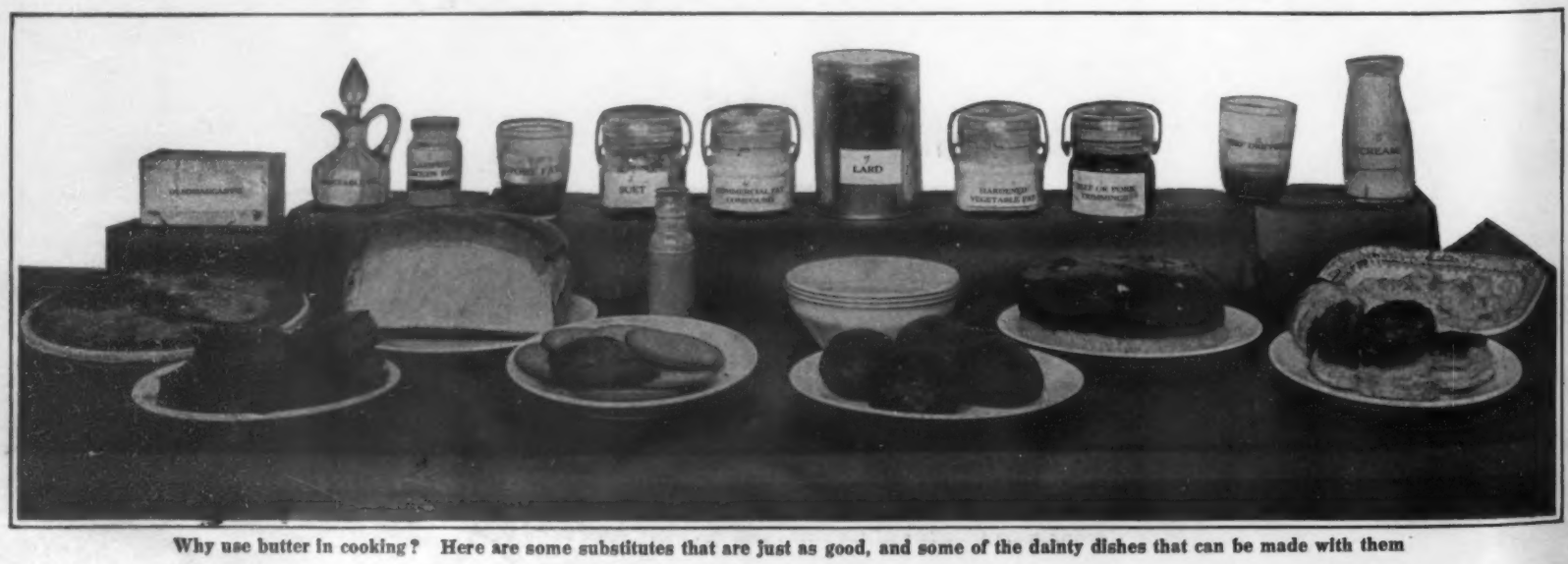
Under such circumstances it was just as well that at the beginning our main reliance was on volunteer cooperation. The first efforts of the Food Administration were toward the mobilizing of the volunteer spirit of the country. The Food Administration was created not to appeal to, but to be composed of, the people of the United States.

The value of volunteer coöperation lay in the fact that it permitted each person to be of aid in the food crisis on the side upon which his interests touched the food problem. If he was a consumer he was asked to reduce his consumption of certain food products in order to leave a surplus to be shipped to the Allies. He was also asked to substitute other food commodities for those for which there was a great demand. If he was a retailer he was asked to aid by carrying into effect the necessary regulations for food distribution to the consumer that from time to time were made. And this volunteer spirit of coöperation was of value in carrying into effect the measures of stabilization that became necessary in the large activities of the food business.

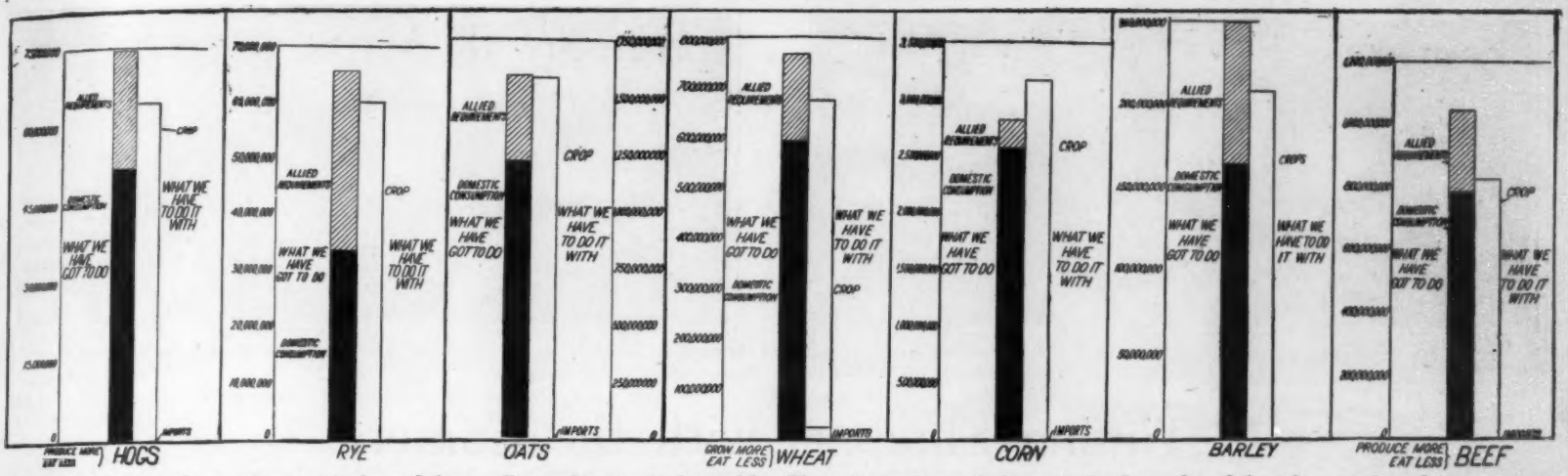
On August 10th, after the Food Adminsitration had been at work on a volunteer basis for 12 weeks, the Food Control Bill was passed by Congress empowering further measures for the conservation of the food supply. By the nature of the food problem and under the provisions of the Food Control Law the scope of food control is restricted to the zone that lies between the producer and the consumer. All measures for the encouragement of the consumer to conserve in his use of food have depended upon a spirit of volunteer cooperation.

The interests of these two groups are paramount in the Food Control Bill. For the support of the Allies and the sustenance of the American people the producer must be encouraged to supply abundant crops and must be compensated sufficiently to cover his increased costs. On the other hand the price to the consumer must be kept as near as possible to the living level. The bill gives no control over the prices of food charged by small retailers, nor over food in the kitchens. The prices at which wheat and certain other commodities could be bought by the Government from the producer were fixed.

In the field between the producer and the consumer, it has been the effort to stabilize food processes, alike for the sake of elimination of waste in the commodity itself and in its handling, and for the keeping of prices at



Why use butter in cooking? Here are some substitutes that are just as good, and some of the dainty dishes that can be made with them



A few of the things that we have got to do, and the supplies we have to do them with. The oats crop is practically up to the demand, and there is a surplus of corn; everything else has got to be stretched to make the white column come out even with the shaded one

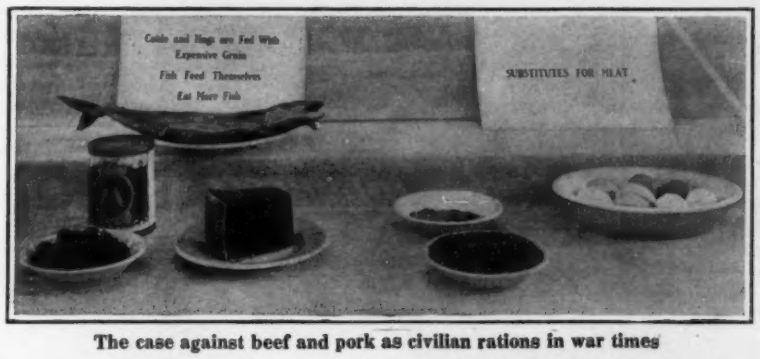
a level of reasonable profit. In this the measures undertaken were partly based upon the force of the Food Control Bill, and partly on the force of patriotic cooperation and the suasion that could be exercised by control of export and by agreement with Allied buyers and otherwise. The Food Administration is now directing the buying of $160,000,000 of foodstuffs a month for the Allies. Even before the passage of the Food Control Law the large purchases of wheat by the Allies, along with voluntary agreements among the large dealers in the trade, had made possible extensive measures in standardization. In a like manner the distribution of sugar was handled through control of the import supply whereby the amount of raw sugar to be delivered to the refineries was governed.

The Food Control Law granted the power to license the handling of food commodities under certain conditions. This license syste.n has now been applied, by Proclamation of the President, to the handling of a large number of food commodities. By means of the license system there have been enforced the requirements that the commodity be kept moving in a direct line, that unfair practices and unreasonable profits at any stage be eliminated, and that speculation be forbidden. It has also been possible to keep an eye on stocks, to see that they are not held too long in warehouses, and to institute proper grading and trade practices.

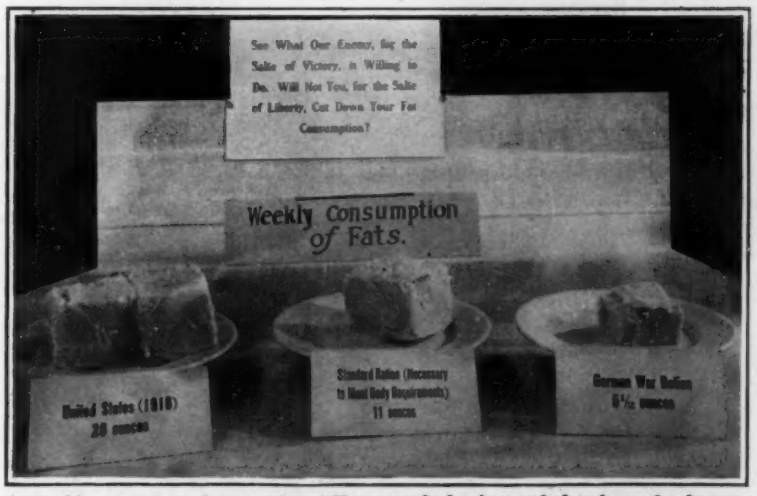
The Food Control Law also gives the Government power to purchase certain commodities, among these being wheat and beans, etc. This power has been applied only in the case of wheat, for which there has been organized the Grain Corporation for undertaking, in association with the Milling Division, the administration of the crops from the farms to the elevators, the apportionment of grain to the millers, the stipulation of processes of milling, the scaling of prices of flour and side products, and the distribution to the consumers and to the Allies. The grain has been followed through its milling processes and into the public bakeries where the processes of baking and distribution of bread have been standardized.

Stabilization is not merely a matter of controlling prices. It is a matter of controlling processes of manufacture, of distribution, and of trade management to avoid wasteful processes in the handling and the financing of the commodity. Under the licensing powers and by voluntary agreement standards of manufacture of food products have been instituted, as in the case of bread, quality grading has been introduced in several commodities, including perishables, and differentials have been determined in commodities, including wheat and cotton seed.

Food is soon found to be connected with widely diversified interests, with transportation, with the well established processes of trade, with people's habits and standards of living. No problem has been more insistent than that of transportation. Not only must the quantity of the food be watched but food supplies must be kept liquid. Efficiency is dependent on transportation to prevent spotty supplies, gluts and famines, and to conserve the interests of perishables in connection with refrigeration. Measures have been taken to secure conservation of food by avoidance of the misuse of transportation systems through the underloading of cars, through cross-hauling and back hauling of food commodities. In certain commodities principles of zone loading have been introduced. In a sense transportation is out of the power of the Food Administration, but in everything that has to do with the indicating of preferentials, the Food Administration is empowered to be of service.



The case against beef and pork as civilian rations in war times

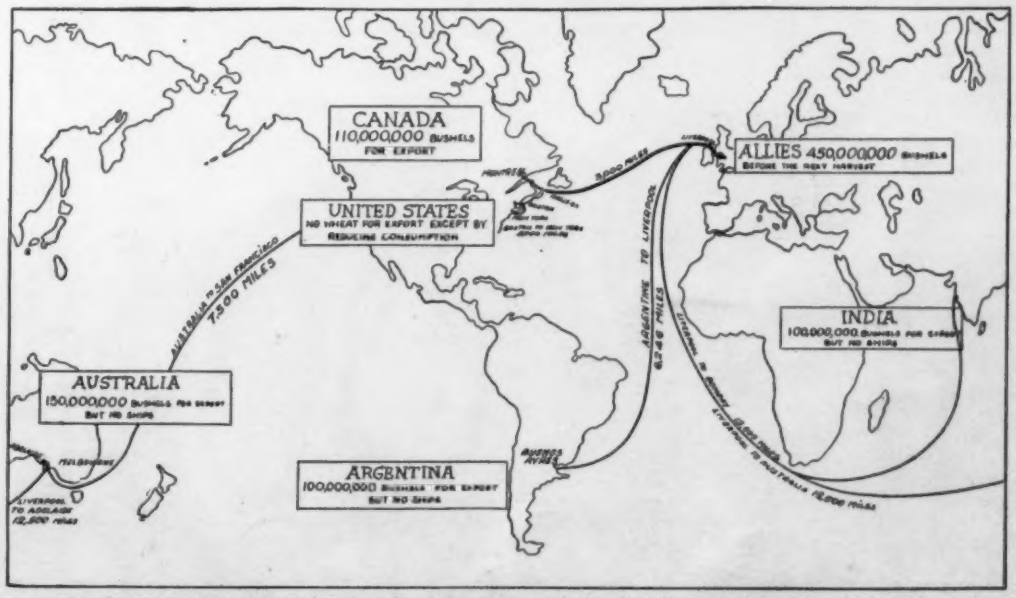

See What Our Enemy, for the Sake of Victory, is Willing to Do. Will Not You, for the Sake of Liberty, Cut Down Your Fat Consumption?
Weekly Consumption of Fats.
United States (1918) 26 ounces
Standard Ration (Necessary to Meet Body Requirements) 11 ounces
German War Ration 8½ ounces

A graphic answer to the question "How much fat is needed to keep the human furnace going?"

As a feature in the stabilization of our food supply the Food Administration cooperates with the War Purchase Board for the proper allocation of purchases for the Army and Navy and for Allied buyers This has been of some service in stabilizing the market through providing security in transactions. Through control of the export market and by volunteer agreement the Food Administration has stabilized the price of hogs at the minimum price of $15.50 per hundredweight on the basis of packers' droves at the Chicago Market.

The purposes underlying stabilization are the complete utilization of all food forces of the country, the avoidance of waste, and the delivery to the consumer at a rate equitable alike to consumer, producer and middleman. Where market machinery was already in shape it has been the policy to disarrange this as little as possible. Where sufficient machinery was not in shape it has been the policy to create it; in some cases the Food Administration had to introduce its own machinery.

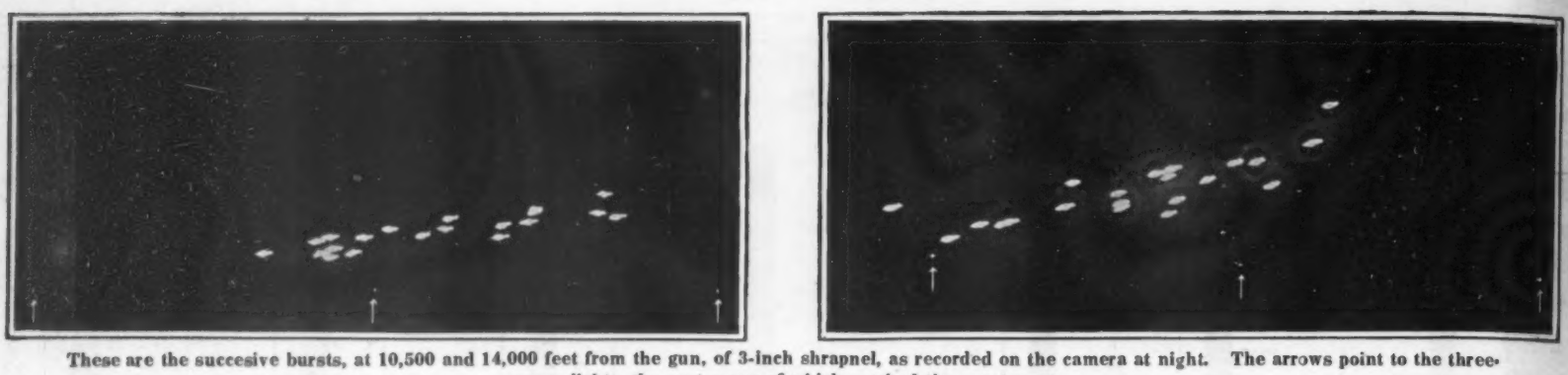
The primary end in all this work has been, of course, the providing of food for the Allies and for America under stress of the demands of war. Everything that has been done has been for the purpose of maintaining food supplies in sufficient qualities and quantities, keeping food supplies fluid in the market, distributing them properly, and encouraging the conservation of food in all hands, from those of the producer to the consumer. We must send an increasing amount of food to the Allies. Whether the margin of control exercised under the law shall be widened depends upon developments in needs. But whatever extra powers are granted there will still be the necessity for continued saving and substitution on the part of the people. If we need to ask the American people for increased sacrifices these will be granted in the same spirit that has already been shown.


CANADA
110,000,000 BUSHELS FOR EXPORT
UNITED STATES
NO WHEAT FOR EXPORT EXCEPT BY REDUCING CONSUMPTION
ALLIES 450,000,000 BUSHELS BEFORE THE NEXT HARVEST
INDIA
100,000,000 BUSHELS FOR EXPORT BUT NO SHIPS
AUSTRALIA
150,000,000 BUSHELS FOR EXPORT BUT NO SHIPS
ARGENTINA
100,000,000 BUSHELS FOR EXPORT BUT NO SHIPS
AUSTRALIA TO SAN FRANCISCO 7,500 MILES
ARGENTINE TO LIVERPOOL 6,248 MILES
LIVERPOOL TO ADELAIDE 12,600 MILES
LIVERPOOL TO AUSTRALIA 12,000 MILES

A graphic demonstration of the wheat needs of the Allies and the shipping requirements which make it impossible to supply them except from the United States. For fuller discussion refer to page 294

Rainbow Bridge

A RECENT professional paper of the U. S. Geological Survey on the geology of the Navajo country describes, as perhaps the most striking erosion feature within that region, a recently discovered natural bridge, which has been named the Rainbow Bridge. It spans Bridge Canyon, on the northwest slope of Navajo Mountain. Its symmetry and graceful proportions make it one of the finest natural bridges of the world.



These are the successive bursts, at 10,500 and 14,000 feet from the gun, of 3-inch shrapnel, as recorded on the camera at night. The arrows point to the three-range lights, the center one of which marked the exact range

Timing Shrapnel with the Camera

How the Shells Were Made to Take Their Own Pictures

By John W. Havens, Photographer at the Eddystone Testing Grounds

THE beginning of the testing of 3,000,000 three-inch shrapnel and high explosive shells for the Russian Government early in 1916, on the Proving Grounds of the Eddystone Ammunition Corporation at Lakehurst, N. J., which was in charge of Capt. C. K. Rockwell, U. S. Army, retired, marked the opening of a new field, in which photography was put to a new use in the United States.

Prior to 1916 the accuracy with which artillery shells were exploded by time fuses had been determined by timing the shells with stop watches from the instant they left the gun until they burst, with more or less accuracy, at the point determined by the setting of the fuse. Innumerable tests by stop watches, both here and abroad, had established the fact that the results obtained were not absolutely accurate, and that there was room for improvement in testing methods.

For the purpose of obtaining more accurate and scientific data upon which to base their measurements and computations in determining the average deviation of a given number of shells, the Eddystone Corporation inaugurated the new system of testing time fuses, which forms the subject of the present article.

The distances from the firing point to the point on the range over which the shells were timed to explode, was marked by a short post. At night a light was hung on this post. On either side of this post, at a distance of 350 feet along the line of fire was a similar post, each having a light hung upon it in the same manner. These lights were about six feet from the ground.

A few minutes before the firing began (at night), the company's photographer was despatched down the range with a camera. Upon the photographer arriving opposite the center light he would turn and ride at right angles, until he reached a bomb-proof situated 1,500 feet south of the line of fire. He would enter and set up his camera, within the bombproof, focussing his instrument so that he had the center light referred to in the foregoing on the center of the plate. This being done, he would telephone to the officer in charge of the firing that he was ready to photograph the burst of each shell.

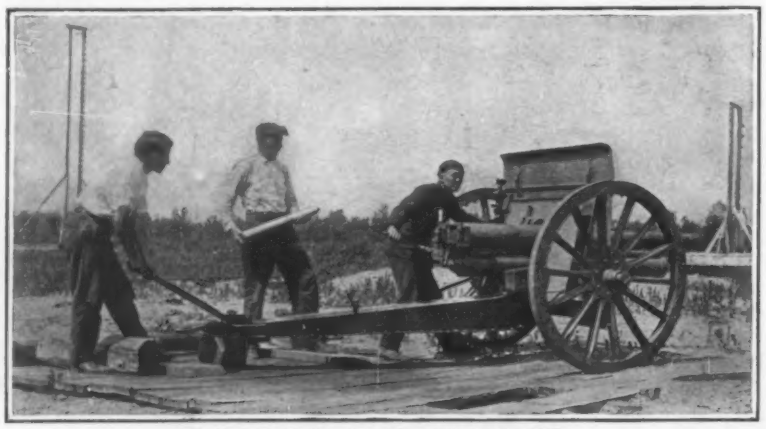
For the convenience and to meet with the desires of the Russian Artillery officers the distances on the range were computed in Russian measurements. The distances at which the shells were timed to explode were as follows: two versts, 7,000 feet; three versts, 10,500 feet; four versts, 14,000 feet; five versts, 17,500 feet.

Each of these points, or desired bursting areas, was marked by three lighted posts, the center light marking the exact measurement from the gun.

Bursting pit for testing unexploded shrapnel

Having telephoned the officer in charge of the night firing that the camera was ready, the photographer left the plate in the camera exposed, until all shells timed to explode at that point had been fired. As the shells burst opposite the camera, their flash was immediately photographed on the plate. The flashes of the ten shots were thus recorded on the plate, together with the three fixed lights.

By keeping a record of the setting of a given number of time fuses, it was possible, by measuring the distance from the center light to each shot, to get the average deviation of a given number of shells.



Testing shells in a Russian 3-inch field gun

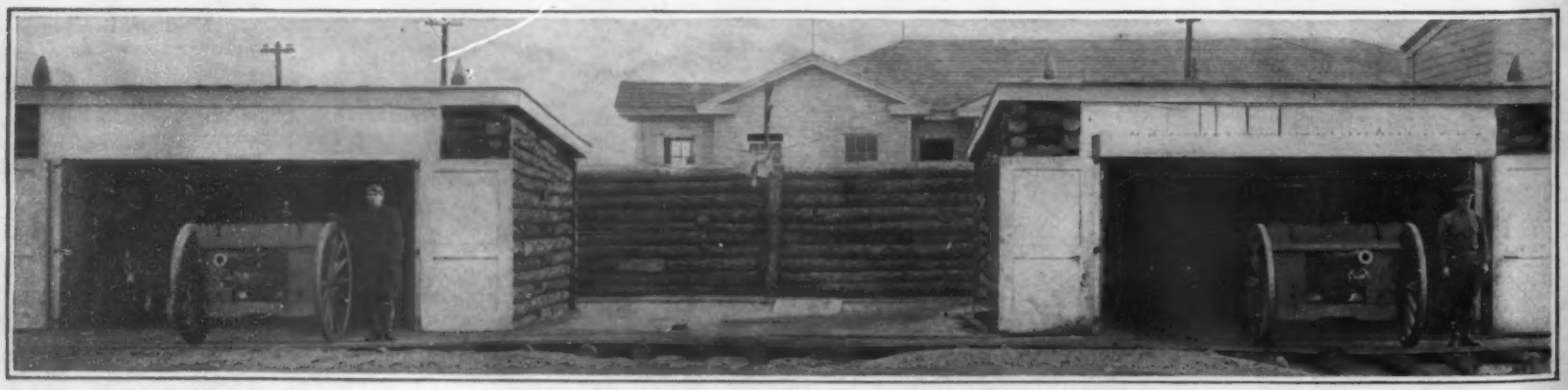
Testing ammunition by daylight on the Eddystone Range also had its interesting features. If a shell failed to explode after being fired, shell scouts, whose duty it was to recover these shells, were sent down the range after firing had ceased, to recover all unexploded shells. The recovered shells were placed in a steel pit and exploded electrically as shown in the picture. By this method they were enabled to determine what feature of the shell was defective.

At the bottom of the bursting pit there is a small iron door, and just before the shell in the pit is fired, this door is opened, so that when the shell is exploded the shrapnel and other contents of the shell are hurled through the door. This relieves the pit of a considerable portion of the force of the explosion, and prevents ultimate congestion of the pit.

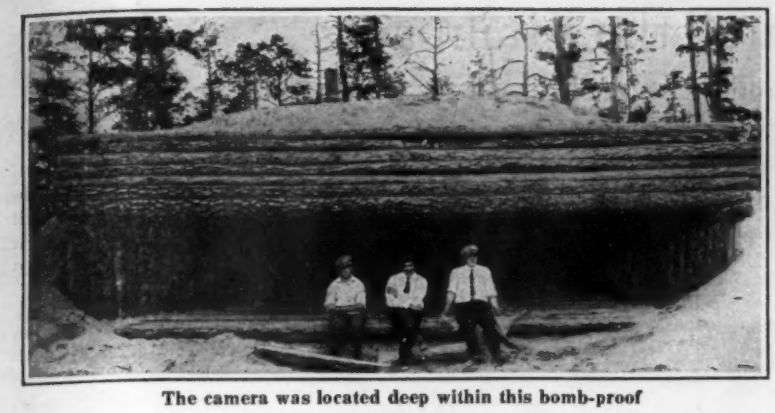
War correspondents, sending stories from the front to their home papers, often refer to the noise made by artillery shells in flight and frequently liken it to a "scream" or a "whistle." The impression that one receives, however, of the noise made by a three-inch shell in flight depends upon two conditions, first: his position relative to the gun at the time the shell is fired. Second: the atmospheric conditions that prevail at that time. To a man standing 25 feet behind a three-inch gun when it is fired on a warm summer's day, with a west wind, the noise made by the shell in flight is scarcely perceptible, and is only heard for about one second; whereas, if the gun is fired during hazy weather, and there is considerable moisture in the air, the noise would sound like the escape of steam through the safety valve of a boiler; and at other times it would sound as if the shell was crashing through a lot of pine boards at some distance, the volume and nature of the noise depending upon the density of the atmosphere. There are, however, conditions under which the "scream" or "whistle" of a shell in flight can be heard.

If a three-inch field gun is fired on a warm clear day, and the shell is timed to explode at a point 17,500 feet from the gun, a man standing 7,000 feet distant from the gun, and at a point about 1,500 feet on either side of the line of fire, would hear a sound resembling a whisper, as the shell passed that point; if he were standing 14,000 feet from the gun, he would be near the point where the shell begins to whistle; and if he were standing at a point 17,500 feet from the gun, and in the same relative position to the line of fire as referred to in the foregoing, he would hear the shell scream and whistle like a demon.

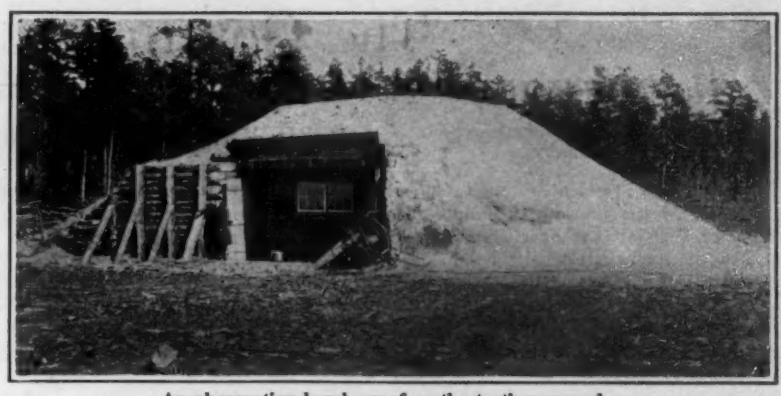
Credit is due to Capt. C. K. Rockwell, and his assistant, Mr. J. W. White, Superintendent of the range, for the ad-



The station from which the shrapnel shells were fired for the photographic test



The camera was located deep within this bomb-proof



An observation bomb-proof on the testing grounds

mirable manner in which the dangerous work of the range was supervised; from the beginning of the work not a man was injured.

Another interesting story from Eddystone is that of the barbed-wire gun here illustrated, recently brought to the Eddystone grounds for test. It fires five rolls of barbed wire simultaneously. The projectile entangles troops in the trenches, and when exploded before advancing troops, it harasses them and impedes their advance.

Each roll of barbed wire is wound around a separate hollow steel arm, each of these is filled with powder; on the top of the projectile is a time fuse connected in the usual manner with the powder in the hollow arms referred to in the foregoing.

When the projectile is fired it rises to a distance of about 200 feet in the air, it then descends and when it strikes the ground, the impact causes the steel arms which contain the powder to burst. This releases and gives momentum to the barbed wire, which spreads out in five different directions.

Trench mortar for throwing barbed wire at the Germans

German Substitutes for Cattle Feed

THE food question which has begun to be increasingly grave in America has long been extremely acute in Germany. This has had the effect of making it necessary, among other expedients, to divert food substances ordinarily used for domestic animals to human use, and to find substitutes for these in feeding cattle, horses, swine, etc. The chief things to be thus replaced are the milk and milk products used in feeding calves and other young animals, potatoes and other tubers, grain and the various legumes, oil-cake, and colonial products not now obtainable; certain plants, moreover, must be reserved for industrial purposes, such as making industrial alcohol, glycerine, etc.

The various methods of obtaining such substitutes may be classified as follows:

Grinding coarse fodder into meal to render it more digestible and mixing with more concentrated or more appetizing food; utilizing portions of cultivated plants formerly plowed under or used for fertilizer; the search for wild plants more or less edible.

As a result of these methods a number of mixed foods have been placed on the market claiming to furnish a balanced ration. These offer many points of interest, as summarized in the *Terre Vaudoise* and in the *International Bulletin of Agriculture*, but it must not be forgotten that they lend themselves readily to adulteration. While the ingredients of these mixed feeds are more or less complex, as a rule, they may be divided into albuminous, fatty, and starchy foods, green fodder roughage, and condiments, according to their predominating quality.

Albuminous or nitrogenous foods, which are the scarcest and dearest, are obtained either from the refuse of abattoirs or from the corpses of animals. In this way dried blood and meat powders are obtained containing as high as 80 per cent of protein and fats. These powders are mixed with heather meal, with the contents of the paunches of slaughtered animals, with malt, and so forth. Moreoever, the tanneries are obliged to put their leather waste at the disposal of the War Committee.

Another nitrogenous food is obtained by cultivating yeast on a large scale; this is grown in a syrupy liquid and has a percentage of mineral elements added to it. It is rumored that this is even fed to prisoners of war. When fed to cattle it is usually mixed with malt. According to the German authority, Kling, such a mixture, when dried, contains 31 per cent of crude protein, 5 per cent each of fats and of mineral ash, and 7 per cent of water. The yeast from wine must be detartrated before using. It contains in the *fresh* state 13 per cent of protein, 5.5 per cent of fats, and 60 per cent water. Milch cows and swine will consume as much as two kilograms (4.4 pounds) per day of this. Another nutritious food, containing 18 per cent of protein, is the oil-cake from beech mast. Cattle will eat this, but it must have salt added, because of the amount of tannin it contains.

Cattle have not the same need of fat as human beings, since they are capable of producing it in their own bodies from the hydrocarbons of their rations. However, it has great energy value and great heat value. It is found as an accessory in the nitrogenous foods referred to above.

It is also found in the oil-cake produced in the Balkans from hazelnuts crushed in the shell. This cake contains 9.5 per cent each of protein, fats, and water. Crushed grape seed, a by-product of wine-making, yields 10 per cent protein, 7 per cent fats and 13 per cent water. Another source both of protein and fat is found in the pods of the cruciferous plant *Raphanus raphanistrum*, commonly called wall-flower, which is found widely growing among cereals. It is obtained largely from the siftings of barley and yields 10 per cent protein and 6.8 per cent fats.

It was even reported in French journals last spring that fats were being extracted from cultures of "asticots," the larvae of the fly *Musca vomitoria*, and being fed to pigs.

Complete photographic equipment for shell testing

Coming to starchy foods, grains naturally are being reserved in the main for human use, though cavalry horses come in for a share. The latter, however, find their rations adulterated with one-third chopped hay and one-third "processed" straw. The treatment of the straw consists in boiling it under pressure in alkaline lessives; while this involves the loss of half the dry substance, including the protein, it renders the cellulose abundant in straw as digestible as starch. If to 70 parts of moist straw there be added 30 parts of mollasses the resultant fodder will contain 5.3 per cent of cellulose, 3.5 per cent protein, 4.7 of ash, 9.3 of water and 29 of non-nitrogenous extractives, 14 of the latter being sugar. In order to double the proportion of albumen lupin seed is added to this after being crushed and deprived of its bitter principle. Fodder thus prepared can be used as a fourth part of the rations of all domestic animals, including swine; horses eat it in place of oats.

Some samples of the innumerable mixed meals exploited in Germany are as follows:

Maize, cob-meal, acorns.

Oats, barley, weed-seed, fish, sea-weed, bran.

Sea-weed, conander-seed, pulp from starch-works, fruit, refuse from preserve factories.

Bones, maize, pods of peas and of beets, bran.

Peanut shells, husks of oats and barley, straw, phosphate of lime, weed-seeds.

Straw, husks, grape residium from wine press, bones, salt.

For fresh fodder the young twigs of trees and brushes are used, as also brakes or ferns, and rhubarb leaves. The latter are said to make an excellent dry fodder, rich in silica and containing much protein.

According to Kling the sea-weed or sea-wrack *Fucus Vesiculosus* has the chemical composition given below:

	Fresh Sea-weed	Ground Dry Sea-weed
Water	38	12
Crude Protein	10.5	6.5
Crude fats	1.0	3.4
Non-nitrogenous extractives	26.8	42
Crude Cellulose	9	20
Ash	14.1	16
	100	100

Experiments with sea-weed as fodder have been made in France and Norway as well as in Germany. It does not impart its odor to the meat as had been feared; its nutritive value is due to lichen starch, to sugars, and to cellulose. It is best to use it dry.

Boiled potato parings are reserved for pigs. Rotten kohl-rabi and kohl-rabi parings are dried and pulverized. Beets are much used since the restrictions on potatoes went into effect, 7 kilograms per day per hundred weight of live weight being the maximum; the animals fatten more slowly than on a potato diet. To increase the nutritive value (the proportion of nitrogen) there should be added cereals, fish, or blood.

For feeding sheep fallen leaves were essayed as also pine needles, but in the latter case the tannin which makes albumen insoluble, doubtless acts the same way upon the intestine, preventing digestion of the complementary fodder. More successful were experiments in feeding swine with fern roots, which contain 42 per cent of dry matter, 4 per cent of which is albuminous and 29 per cent non-nitrogenous extractives. But here the cellulose requires so much digestive labor as to compromise the assimilation of the other and nutritive elements.

The Government and the Railroads

The Coördination of Two Hundred and Sixty Thousand Miles of Railroad for the Winning of the War

By J. Bernard Walker, Editor of the SCIENTIFIC AMERICAN

WHEN the President, through the Secretary of War, issued the proclamation and order by which a Director General took over the railroads of the United States, the immediate result in the stock market was a rise in values of the securities of the railroads. No finer vote of confidence in the government was ever voiced by the financial interests of the country, particularly when it is considered that General Order Number One particularly stated that all transportation systems covered by the proclamation would be operated as a national system of transportation, the common and national needs being in all instances held paramount to any actual or supposed corporate advantages, and that all terminals, ports, locomotives, rolling stock and other transportation facilities would be fully utilized to carry out this purpose without regard to ownership.

Of the many problems which government control of railroads raised for immediate solution, none were greater than those of public opinion and railroad opinion. Without a united public acquiescence in necessary inconveniences, and a feeling of real confidence in the need of the order, little constructive work could be done, and it is obvious that without railroad coöperation, the welding of many private interests into one public interest would be a slow and difficult task—and speed was an essential.

It was highly important that the railroad executives learn willingly and quickly to grasp the entirely new standpoint that all the railroads now constitute a single system to be operated so as to secure the maximum of transportation with the minimum of waste, and that even though the course of readjustment causes a particular railroad to lose certain sorts of traffic, this must be disregarded as an insufficient reason against the readjustment, if in other respects it is in the public interest.

There were those who prophesied failure, believing that the fear of permanent government ownership would cause many roads to lend less than a full measure of coöperation, in the hope that government operation would thus be a failure. They were wrong. The railroads have coöperated and the many different lines of this country stand today as a united single system, not because of the order or the organization effected since it was issued, but because of the patriotic spirit of cooperation with which the railroads have met a revolutionary situation.

It was obvious that the government must keep the existing personnel to operate the roads. Neither efficiency of operation nor public interest permitted any other course. Yet it was also natural that the general public would to some extent distrust the railroad manager trained in the competition of commerce when he became a government agent of a part of a government road which might, nevertheless, some day become a private road. The public naturally is apt to regard the high railroad official as imbued with the attitude of private management, no matter how disinterestedly those managers may be endeavoring to represent the public interest and nothing else.

Therefore, in outlining the policy of organization and the exercise of government authority, the three Regional Directors, who have charge of the three divisions into which the country has been geographically if arbitrarily divided for organization purposes, are making no changes which primarily affect the public, without the knowledge and sanction of the Director General.

The public has met the inconveniences which the mobilization of the railroads for war work has produced in a splendid spirit. The primary reason for the government taking over the roads was to end an intolerable congestion, speed up freight, and move material and men—quickly. This has necessarily meant a curtailment of passenger trains, a revision of schedules, and inconveniences to the traveling public.

But no passenger trains have been discontinued without much careful thought—those changes in passenger schedules which have been made were necessary to enable the government to deal more effectively with war needs and war problems of paramount importance. Local and individual interests could not be permitted to stand in the way of the supreme need of the nation, which is to use all the facilities and resources of the country to win the war.

This winter's breakdown of passenger service in the East did not make a pleasant impression on the public; and official curtailment undoubtedly added both to this feeling and to the hardship. But the elimination of unnecessary passenger train service released much motive power, skilled labor, track and terminal facilities for the handling of coal and food and other supplies essential to the life of the people as well as to the successful prosecution of the war.

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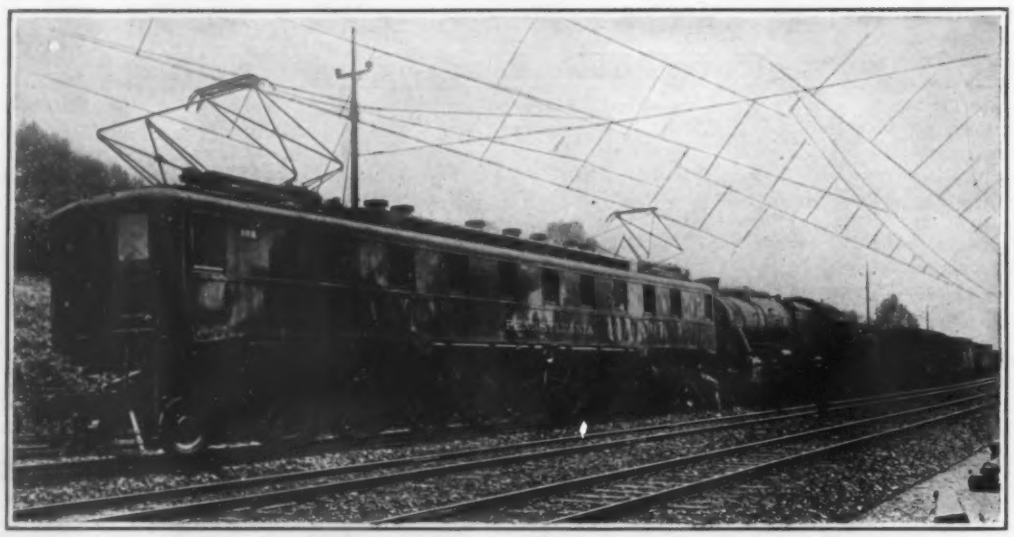
A group of steam locomotives built for the United States government



A huge electric locomotive built for service in the Alleghany mountains

It is as impossible to weld many railroad systems, hitherto competing each with the other for business, into one smoothly working whole, without at least financial damage to some private interest, as it is to make an omelette without breaking eggs. But every effort has been and is being made, to cause as little inconvenience and trouble as may be. Thus, no changes in the present methods of accounting as prescribed by the Interstate Commerce Commission are required. Accounts were closed on December 31st and opened January 1st, 1918, in the same manner as they have heretofore been handled at the close of one fiscal period and the beginning of another; and in the same manner as they would have been handled had the Government not taken possession of the roads.

It has been necessary, for obvious reasons, to require that no operating revenues be expended for payment of agents employed to affect legislation, for employing attorneys not doing necessary legal work, for paying the expenses of agencies constituting associations of carriers (unless approved in advance by the Director General), or for any political purpose or for the influencing of any election affecting any public measure. But, as far as possible, the financial side of railroad operation has not been interfered with. A delicate and well adjusted machine is best left alone until entire attention can be given to it, and at present much larger problems occupy the stage.

Not least among them is that of labor.

For some time there has been a growing spirit of unrest among railroad employees, in which has been blended a dissatisfaction with wages, with hours, and with some of the many phases of the relation of the employer to the employee. With many of the resulting disputes, in some cases ending in threats of strikes or lock-outs, the public is familiar. Many of these complaints and demands were brought to the attention of the Director General shortly after the assumption of the operation of the railroads by the government. They came in all forms, from various classes of railroad labor organizations and from various groups of unorganized employees of the railroads.

It would have been the worst possible policy to disregard these symptoms of unrest merely because the power of the Nation stood behind the present government control of railroads. But the shaping of so big a thing as a government policy towards the many hundreds of thousands of its railroad employees takes time, and cannot be intelligently done without complete information. That information is now being gathered. Pending it, the Government has done everything it could do to impress on the railroads, from their presidents to their section hands, that in this time of great stress the attitude of every employee should be determined by the supreme need of the hour—duty to his country first of all. The Director General has everywhere emphasized the necessity for devoted and loyal service by every man in this emergency. Every railroad employee is now in effect a Government employee and as much in duty bound to give his best service to his country as if he wore the uniform of the United States Army and occupied the trenches at the front. Every unnecessary delay in a train movement vitally affects our soldiers and sailors and seriously impairs our ability to defend our rights and our liberties. Every man whose neglect or indifference causes such delays may be responsible for the loss of the son of some noble American mother or father. It is as serious to the country for any railroad employee to be a slacker in his work as it is for a man to be a slacker in the Army or in the Navy.

But while depending for the present upon patriotic coöperation of the railroad army to enable government control to accomplish those things for which it was instituted, the Director General does not lose sight of the fact that the question of wages and hours is a pressing one, and one which has two sides.

Thoroughly to understand both sides, a Railroad Wage Commission, consisting of Franklin K. Lane, Secretary of the Interior; Charles C. McChord, member of the Interstate Commerce Commission; J. Harry Covington, Chief Justice of the Supreme Court of the District of Columbia, and William R. Willcox of New York, has been appointed for the purpose of making a general investigation of the compensation of persons in the railroad service, the relation of railroad wages to wages in other industries, the conditions respecting wages in different parts of the country, the special emergency respecting wages which exists at this time owing to war conditions and the high cost of living, as well as the relation between different classes of railroad labor. This Commission has begun its labors and will make its report to the Director General, giving its recom-

mendations in general terms as to changes in existing compensations that should be made.

Pending a disposition of these matters by the Director General, all requests of employees involving revisions of schedules or general changes in conditions affecting wages and hours, are to be held in abeyance by both the managers and employees. Wages, when determined upon, will be made retroactive to January 1st, 1918, and adjusted accordingly. Matters of controversy arising under interpretations of existing wage agreements and other matters not relating to wages and hours will take their usual course, and in the event of inability to reach a settlement will be referred to the Director General.

One labor question had to be met at once—the matter of railroad organizations, or labor unions, as they are commonly called. It was met exactly as the same question has been met by the government before—by the inflexible rule that no discrimination can be made in the employment, retention or conditions of employment of employees because of membership or non-membership in any labor organization

However much this may please those who do not approve of unions, or displease those who find in them a great power for good, there seems to have been little commotion caused by this ruling. The new spirit of patriotism makes it possible to realize that the government now being in control of the railroads, the officers and employees of the various companies no longer serve a private interest. All now serve the government and in the public interest only. The officers and employees have grasped this spirit of the new era. Devotion to country, determination to perform the imperative duties of the hour while the life of the nation is imperiled by war, is obliterating old enmities and making friends and comrades of former antagonists. Coöperation, not antagonism; confidence, not suspicion; mutual helpfulness, not grudging performance; just consideration, not arbitrary disregard of each other's rights and feelings; a fine discipline based on mutual respect and sympathy; and an earnest desire to serve the great public faithfully and efficiently, mark the new spirit and purpose for which the Director General is striving and which is spreading with gratifying rapidity to every part and branch of the national railroad service.

One very important ramification of government control of railroads is the attempt to extend transportation facilities by increasing the use of inland waterways and other water bodies. The present emergency is to be solved by *any* means of transportation which will get goods to the seaboard, or from mine to factory, in the least possible time, with the least possible expense and the use of the least possible number of men.

Hence the appointment of a Committee on Inland Waterways is of real importance. It is now making an investigation and will as soon as practicable report a definite plan describing the extent to which and the manner in which additional use may be made of the internal waterways for the economical and expeditious movement of traffic of the country so as to relieve or supplement the railways under existing war conditions. While the entire waterway and transportation situation is to be scrutinized, only those waterways that will effectively afford national relief will be included in the plan to be presented. In addition, the recently created Marine Section of the Division of Transportation is supervising the operation of the shipping under the control of the Director General and also giving special attention to coördinating the relations between all other shipping (including that on the Great Lakes) and the railroads.

The program now being followed in running the vast network of American railways as one system is not only to be considered in the light of expediting freight through a pooling of resources, terminals, cars and locomotives. If it is not a constructive program, which will continue the progress of the individual roads towards that ideal which all railroaders have for their systems, it must in the end collapse. Whether government ownership of public utilities is a good thing or a bad one, whether it will be a success or a failure if tried as a peace and not a war measure, are matters which cannot be disussed here. But if this present control of railroads is to be a success, it must further, not hinder, the normal development of transportation means, as well as transportation of war materials and men.

Thus, most of the larger railways devote much care, attention, time and money to the matter of safety of operation, not only because it is less expensive to run a safe road than a dangerous one, but from a genuine desire to serve the public as well as possible. This work, so far from being hindered or stopped, is to be extended. The Director General feels strongly that there should be no abatement in safety work but that there should be centralized supervision, not only to insure proper practices but also in order that each railroad may promptly secure the advantage of experience which other roads have had in the development of safety work.

To this end the Safety Section of the Division of Transportation was created, and Mr. Hiram W. Belnap appointed Manager, with office in the Interstate Commerce Building, Washington, D. C. The Manager of the Safety Section has supervision over the safety work on all railroads, utilizing such safety organizations as are already available and suggesting such others as are desirable, in addition to his present duties for the Interstate Commerce Commission as Chief of its Bureau of Safety.

The decision, in the hands of authority, as to what is and what is not an essential to war purposes is of paramount importance. No industry but feels itself vital, and any industry prevented from exercising its capacities to the fullest degree, may well be excused for feeling aggrieved if government control of transportation interferes with its labors. Yet inconveniences, and what at the time may seem apparent injustices, are inseparable from running the railroads for the good of the nation as a whole. The responsibility of placing an embargo upon shipping of any kind is a great one. The use of this power as a means to a good end can only be compared to its power for evil if misused.

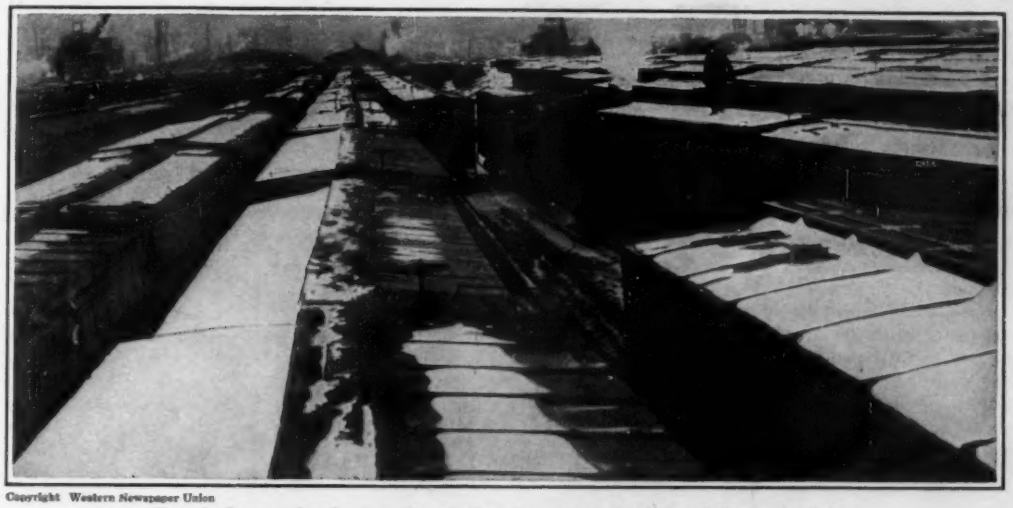
On account of the severe weather, particularly affecting railroads crossing the Alleghenies, the Director General this winter authorized an embargo upon all freight except food, fuel and certain war munitions and supplies, upon the Pennsylvania Lines east of Pittsburgh, Baltimore and Ohio east of the Ohio River and the Philadelphia and Reading, for the purpose of enabling those lines, the heaviest bituminous coal carriers, to continue specializing upon coal for the double purpose of supplying the acute conditions in New England and the Harbor of New York and elsewhere, and providing empty cars for mines and coke ovens.

But no embargoes will be placed upon any class of goods or affecting any roads, at any time, which can possibly be avoided; and no locality need fear that the government will become a Juggernaut, riding unheeding over the necessities of any of its people, merely because it has the power.

It is impossible to say what the future will bring forth. The Director General is planning as much for the future as is possible; but in an era when no man knows today what tomorrow may see, too far-sighted a policy may be a detriment and not an asset. Nevertheless, there are certain things which are being considered, very carefully, and many investigations that are being made under the authority of government control, looking to improvement in transportation conditions. Among them may be mentioned a very careful consideration of the many facts bearing on the discontinuance of additional passenger service to save coal, labor, locomotives and shop capacity for freight service, while giving due weight to local passenger necessities and the need, if not the easy convenience, of the traveling public.

Freight solicitation, also, is having careful attention.

(Concluded on page 331)



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A typical example of congestion during the severe weather of the past winter

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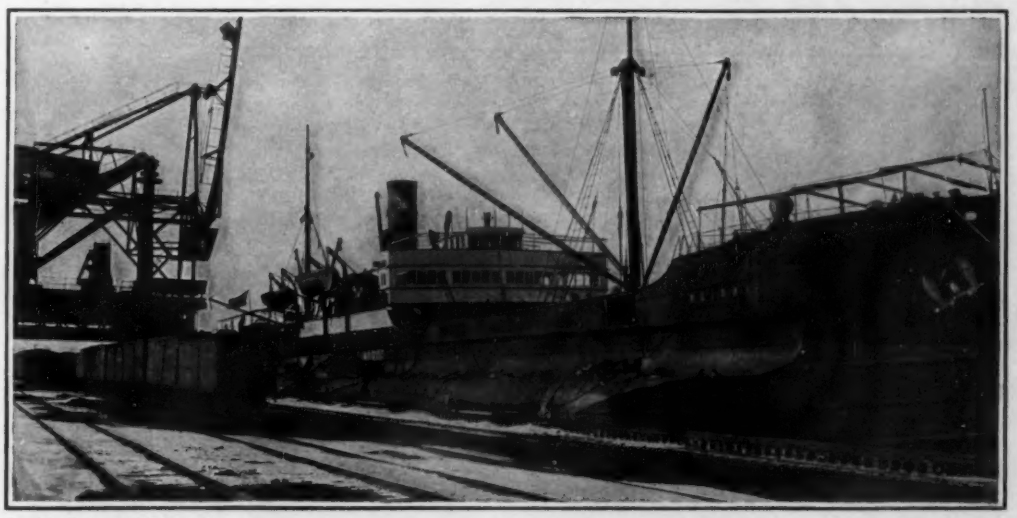
A New York terminal; where freight is transferred from rail to water



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Loading freight from the cars directly into the steamer

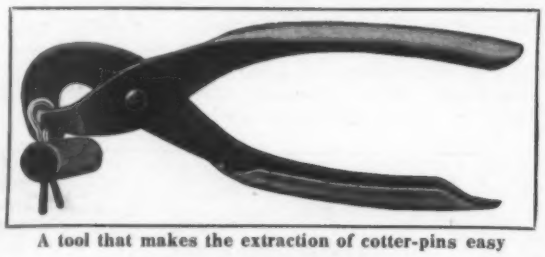
Inventions New and Interesting

A Department Devoted to Pioneer Work in the Arts

A Cotter Pin Extractor

EVER try to get one out with ordinary tools? The average motor car contains 30 of these little pins, and many of the bigger cars have as many as 50. Yanking them is a difficult job for any amateur repair man, unless he is equipped for the job.

This little device, about the size and shape of a pair of pliers, pulls out a cotter pin as easily as a painless dentist pulls a tooth. One prong engages the pin while the other uses all the leverage exerted against the member through which the pin is inserted. Since this leverage is four times as great as the actual force used, the pin comes out quickly and easily.



A tool that makes the extraction of cotter-pins easy

A Sanitary Mop Shaker

DOES your neighbor in the apartment upstairs or across the alley make a practice of shaking a dusty mop out of the window, so that your open windows get the full benefit of the dust thus released? Under old conditions there was a good deal of excuse for this; for dusty dust-mops must be shaken out, and if not out of doors and windows, where? But now all occasion for this unsanitary and unsightly procedure is eliminated by the ingenious dust-shaker which we illustrate. Armed with it, the wielder of the dust-mop can keep her weapon in good condition at all times, and without making a neighborhood nuisance of herself. And, if the thing must be put upon a selfish basis in order to induce some people to use it, she can clean her mop without dodging the cloud of dust which an unfavoring wind has been wont to hurl back in her face through the open window. Attention is called to the paper or cloth lining of the dust receptacle, which makes final disposition of the accumulated dust a simple matter.

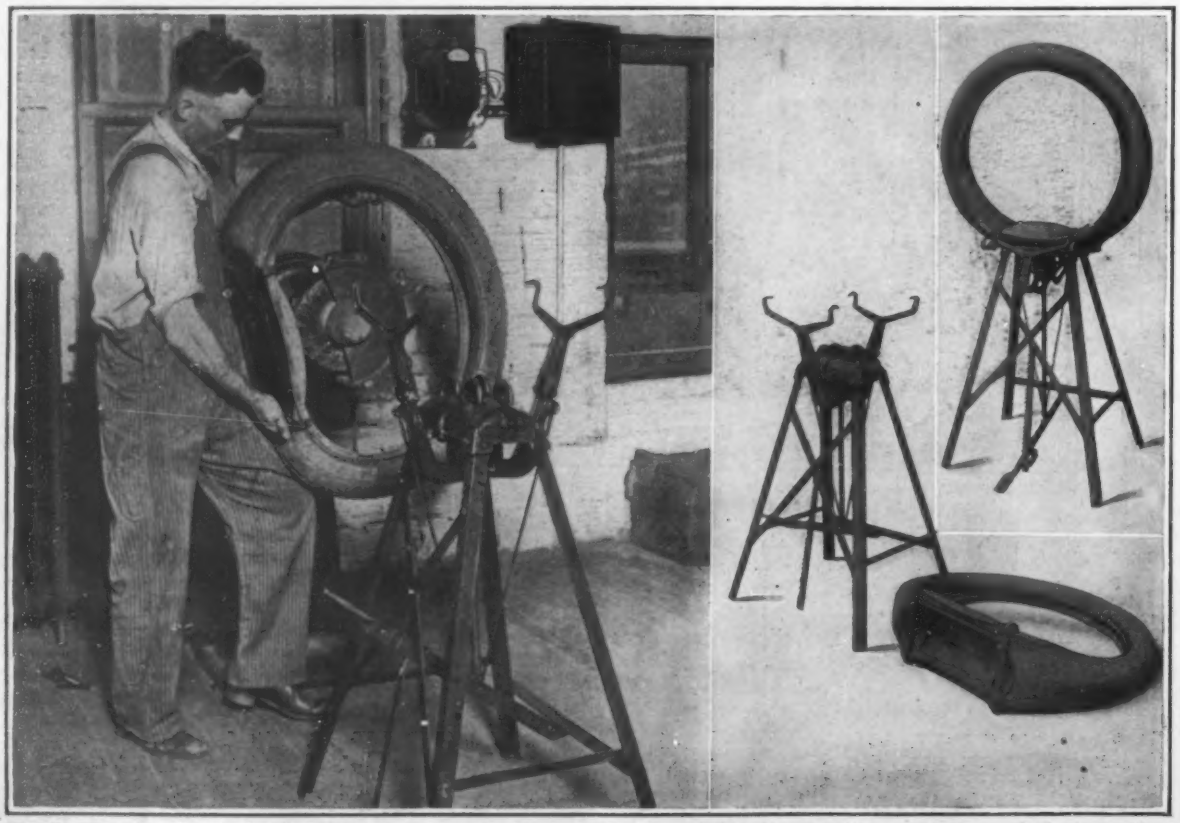
Exploring the Inside of a Tire

IT has always been a rather awkward matter to get at the inner tube of a tire to locate and repair a break—that is, by any method short of actually dissembling the whole tire and dragging its internals out into broad daylight. An inventor of Springfield, Ill., however, has now put out a device which he is sure will change the whole complexion of things in the tire-repair shop.

We have here, first an ingenious little pair of mechanical fingers which are inserted into the beading, and which distend the opening between the two edges to three or four times its natural size. Then we have, under these fingers, a group of small rollers. When these are rotated, the whole tire moves slowly about, the spreader sliding about inside as the rollers roll on the outside; and the apparatus is cleverly arranged so that the rollers support the weight of the tire under this treatment and take up any strains to which the fabric would otherwise be subjected by the operation. Of course, the rollers and the fingers are so adjusted that the harder the fingers pry in their search for the concealed vitals of the tire, the more the rollers yield under the pressure and gradually back away into their housing.

The idea of all this is, of course, to find the damaged spot without crawling into the outer tube or removing the inner one completely. But this is not all that is to be done.

Once the offending region is exposed to view, a buffing plate takes the place of the spreader fingers, and affords a solid background against which adequate buffing is so easy that the whole area around the hole is transformed into a smooth surface of clean rubber in less time than it takes to tell the reader about it.



The tire spreader with the buffing wheel in action; the fingers and rollers that do the spreading; and the method of operating the spreader to get the tire on or off

Notes for Inventors

Filament Lamps for Motion-Picture Projection.—Great progress has been made during the past year in the application of the high power filament lamp to motion-picture projection. It seems only a matter of time before the arc lamp now in general use will be replaced by the steady, reliable, simple and clean nitrogen-filled lamp.

Cleaning the dust mop without creating dust

Two Lamp Sockets in Place of One.—Among the many devices already introduced for providing two lamp sockets instead of one in connection with electric light circuits, is that of August Bouchery of Brooklyn, N. Y. In this particular case the device consists merely of a plug provided with a pair of arms, each terminating in a socket. Thus any single socket by means of this device can be converted into a twin-socket fixture.

A Milk Can Which Keeps Itself Cool.—Taking the ordinary milk can, Herbert G. Nelson of Chicago, Ill., has provided it with a number of inclined tubes running the full length of the can and terminating at the upper end in an opening on the shoulder. A cap is provided for each tube. Filled with cracked ice, the tubes are calculated to keep the milk cold during transit.

A Wooden Tone Arm for the Phonograph.—It has remained for Henry Lobschutz of New York city, to produce a wooden tone arm for the phonograph. For practically its entire length the tone arm designed by this inventor is made of well-seasoned wood, while at the free end it connects with a short metal tube which carries the sound box. In this manner the metal of the tone arm is almost entirely eliminated, and it would seem that the tonal properties should be improved.

Lights for Shavers are common these days. All kinds of electrical attachments for safety razors have made their appearance during the past year. Just now it is the shaving light of Otto F. Steufer of Cleveland, Ohio, which is of interest, since he has assigned his invention to a leading manufacturer of electrical apparatus. This inventor places a diminutive electric light in the handle of the safety razor, just above the part gripped by the hand. In this manner light is thrown where needed, and the electrical equipment in no way interferes with the shaving operation. Current is furnished by a separate battery and through a flexible twin-conductor cord.

Clip Loading Revolver.—The main advantage of the automatic pistol over the revolver is its rapidity of fire and quick reload. It is especially the latter feature which has brought it into such universal use. By providing a revolver with a circular cartridge frame or clip, however, Joseph H. Wesson of Springfield, Mass., appears to have given the same feature to the conventional revolver. His clip, holding five or six cartridges in position, serves to push them into place in the revolver barrel at one operation, instead of individual loading as is usually the case.

Gun Muzzle Protector.—In a recent dispatch from the front it was stated that American troops had captured enemy rifles that were protected by ingenious breech-mechanism covers and muzzle covers. With regard to the latter, however, it is well to direct attention to the rather ingenious device of Christian Weyand of Buffalo, N. Y. This consists simply of a clip which fits over the end of the barrel, and which is provided with a hinged flap covering the muzzle. Normally, the flap is pressed tightly against the muzzle by a coiled spring.

An Adjustable Curve.—A most ingenious drawing instrument for making curves has recently been patented by Kenneth W. Nevers of Athol, Mass. This device consists of a bow, a flexible rule pivoted at its ends to the ends of the bow and having a pair of inwardly extending studs, a flat reinforcing spring contacting with the inner side of the rule and having slots receiving the studs, and a screw-threaded adjusting device extending between the center of the spring and the bow. By adjusting the screw-threaded member the curve may be changed to meet all requirements within the range of the instrument. Perhaps the greatest application of this device will be in laying out parabolas of varying sizes.

The United States Transportation Co. is using Troy Trailers exclusively in hauling freight to and from the Cardiff Mines in the Big Cottonwood District, Utah. Read their letter:—

"The road over which these outfits are working is one of the severest in this country and affords a great many obstacles for any kind of hauling equipment. The use of heavy mountain freighting wagons, pulled by four horses, would go to pieces in two or three months, and every three or four weeks 1-inch tires would have to be replaced. This is due to the excessive grades, the severe roads and sharp curves.

"The Troy Trailers have been working up and down the canyon for the past four months and have not caused one cent expense, for either tire replacement or repairs. We haul about six tons on each trailer and also have bodies which weigh practically 1400 pounds. The snow began falling in this canyon about August and the outfits have been operating in snow and ice from one foot to three feet in depth ever since. We are unanimous in our approval of the TROY Trailers, both for the service they are giving and the trouble they are not."

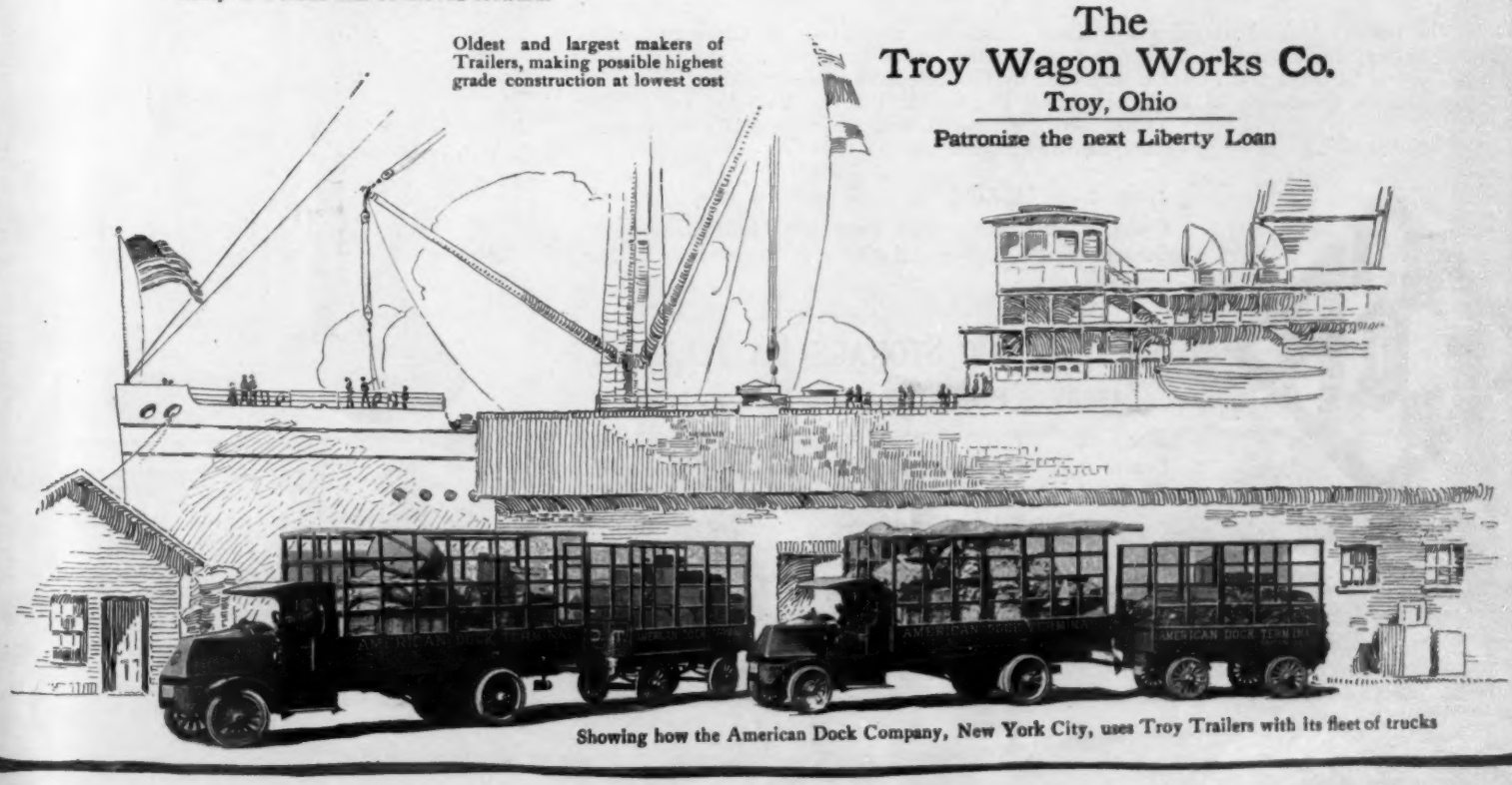
Troy Trailers are made in from 1 to 5-ton capacity, and with any type of body desired. The truck can be attached to either end of the trailer. Troy Trailers, due to their being built double-ended, can be backed into any exact location as easily as a truck can be moved forward.

Oldest and largest makers of Trailers, making possible highest grade construction at lowest cost

The Troy Wagon Works Co.

Troy, Ohio

Patronize the next Liberty Loan



Showing how the American Dock Company, New York City, uses Troy Trailers with its fleet of trucks

The Home of the "Exide" GIANT

The battery in your automobile is there for just one thing—to put "power and punch" into your starting and lighting. This it must do consistently and dependably.

You don't want to worry about it, you don't want to fuss with it; what you do want is to know what it is there, ready to swing its power into *performance* the instant it's needed.

And that's the reason for the "Exide" Battery—the "Giant that Lives in a Box." It is the Original Unit-cell Battery.

It's a battery that's right in every respect—*proved* right by long years of service in all sorts of cars under all sorts of conditions.

It is the battery that is sold you on a *throughout quality* basis—not on the strength of one highly individualized talking point.

It is the battery behind whose performance stands the reputation of the oldest and largest battery maker in this country—the company whose batteries are used by the large Central Lighting and Power Companies, by the Telephone, Telegraph and Wireless Companies, in thousands of House Lighting Plants, for Electric Vehicles, Industrial Trucks and Tractors, Mine Locomotives, Battery Street Cars, Railway Signals, etc.

There is an "Exide" perfectly suited to every type and model of automobile—and there are "Exide" Service Stations located in principal cities and towns throughout the country.

THE ELECTRIC STORAGE BATTERY CO.

1888 PHILADELPHIA, PA. 1918

New York Boston Chicago Washington
Denver San Francisco St. Louis Minneapolis
Cleveland Atlanta Kansas City Pittsburgh
Detroit Rochester Toronto

"Exide", "Hycap-Exide", "Ironclad-Exide", "Thin-Exide", "Chloride Accumulator", "Tudor Accumulator"

Selden Trucks Will Help Win the War

NOW is the time when all industries MUST aid the government in every way possible TO WIN THE WAR—NOW when the ranks of labor have been thinned by the drafting of man power into military service—NOW when the freight terminals are congested with thousands of freight cars standing on the tracks waiting to be unloaded so their cargoes may be taken away and delivered.

To move this congested freight away from the terminals is the problem that confronts us to-day.

But man power is scarce.

Release the excess labor employed in your business. Employ motor trucks to do the same work with fewer men—to move your freight away from the terminals as fast as it arrives and to make your deliveries—in less time—with greater satisfaction to your customers—at a lower cost and, therefore, with greater profit to you.

Relieve the railroads from short hauls up to 50 or 100 miles or more. Give them a chance to handle the long hauls on schedule time.

Install big, powerful SELDEN TRUCKS to do the job. They will bear the heavy burdens of war-time congestion without strain and continue to render profitable service for years after WE WIN THE WAR.

Massive construction—colossal strength—gigantic motive power—abundant speed in operation—proven power of endurance, with sufficient energy in reserve—these "In-Built Qualities" of SELDEN TRUCKS give them the vitality to work under high pressure indefinitely without weakening.

There are six Worm and Internal Drive models of One to Five Ton capacity in the Selden Line. Write for full information.

Buy a SELDEN—Its ALL Truck

SELDEN TRUCK SALES COMPANY

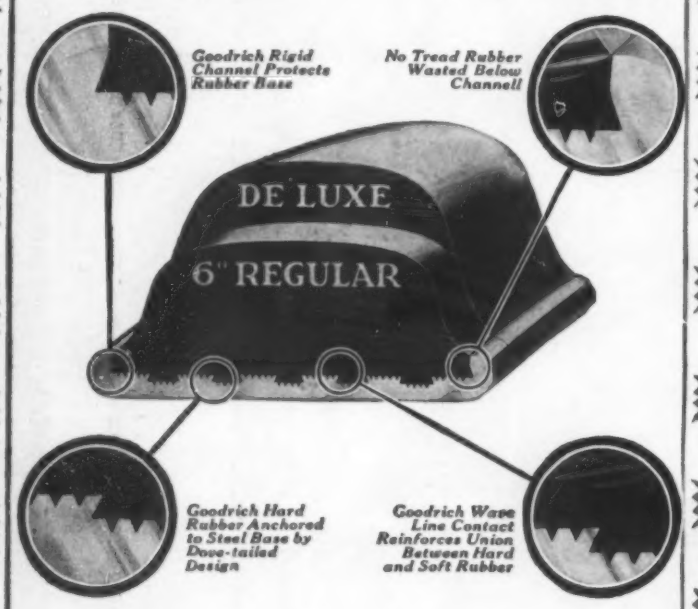
ROCHESTER, N. Y., U. S. A.

Selden Trucks

IN-BUILT QUALITY · SELDEN · MOTOR TRUCKS

DE LUXE

EXTRA THICKNESS VELVET MILEAGE


Goodrich Rigid Channel Protects Rubber Base
No Tread Rubber Wasted Below Channel!
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6" REGULAR
Goodrich Hard Rubber Anchored to Steel Base by Dove-tailed Design
Goodrich Wave Line Contact Reinforces Union Between Hard and Soft Rubber

Vibration Problem Solved!

BY ACTUAL test, the *cushioning qualities* of Goodrich De Luxe Truck Tires are 50% to 100% greater than in regular tires of corresponding widths.

The greater heights of tread rubber mean *truck insurance plus tire economy.*

You can readily see why De Luxe Tires *must* reduce repair costs, lessen depreciation, prevent truck lay-ups and prolong truck life.

Goodrich De Luxe Truck Tires outclass ordinary tires in thicker tread at the start; in velvet mileage at the end. Get them at any Goodrich Service Station.

THE B.F.GOODRICH RUBBER COMPANY
Akron, Ohio

GOODRICH
TRUCK TIRES

The Current Supplement

BIOLOGY offers an almost limitless field for the investigations of the savant, and the results of their studies are usually followed with interest by the general reader of scientific literature. In the current issue of the SCIENTIFIC AMERICAN SUPPLEMENT, No. 2205, for April 6th, will be found a recent paper by a French investigator on *An Important Biological Problem*, which deals with the significance of essences and pigments. Archeological explorations in Rome have brought to light pagan remains of Syrian origin, and some of these are described, and their interpretation discussed, in an article entitled *Syrian Remains Discovered in Rome*, illustrating which are two original photographs. *An Interesting Double Star* tells us something about "Kreuger 60," and there are two explanatory diagrams. Our annual summer insect plague, the mosquito, will soon be with us again so the paper on *The Mosquito Question*, which considers migration as a factor in control, is one of timely importance. *The Cruisers of the Rails* tells of the batteries of naval guns, mounted on railway cars, which have done most effective work with the French armies. An excellent photograph shows one of these batteries, camouflaged in the latest approved fashion. *Mediaeval Choir Stalls* describes and illustrates a large number of designs of decorated misericord seats to be found in the old churches of England. The romantic paper on *The Sikhs* is concluded in this issue. *A Simple Line Dividing Instrument* describes and illustrates an easily made tool that should be useful to many readers. *Notes on a High Temperature Thermostat* describes and illustrates one of a class of instruments that are becoming necessary adjuncts to many manufacturing operations. *Developments in Alternating-Current Work* gives the technical story of the frequencies in a way intelligible to all, and makes clear some electrical matters frequently referred to in technical articles, but which are not understood by the layman.

One Year of War

(*Continued from page 297*)

weapon and the toxic effect of each new gas has to be neutralized by new chemical combinations in the gas mask carried by both men and animals at the front. Gas defense has become an important branch of our work. A large chemical manufacturing plant has been established by the Government and is now producing chemicals which possess the preventive powers required. A highly efficient type of gas mask has been invented and as large numbers of these masks are required, a daily output of many thousand masks will be attained in the near future.

When a man enters the Armies of the United States, the War Department not only assumes full responsibility for his physical welfare, but also for his spiritual and cultural well-being. The discipline of the military training sets men up and broadens their vision as to their responsibility toward the State, yet at the same time has a tendency to break down the ties of normal social relationship, and above all, individual responsibility toward the civilian community. To deal with this problem and watch over the welfare of the men, during the first days of the war, a Commission on Training Camp Activities was created to "supply the normal ties of life to nearly a million and a half young men in training camps, to keep the environs of these camps clean and wholesome and to rationalize as far as it can be done, the bewildering environment of a war camp."

The Y. M. C. A. and the Knights of Columbus have taken a large share in the work. In each National Army cantonment, from nine to fourteen recreational and social buildings have been erected. A fully equipped modern theatre seating 3,000 people is provided for in each camp and a series of professional entertainments is booked through a committee of leading theatrical managers.

Recreative athletic work, camp singing, coöperative stores, and library facilities are supplied. Educational work in matters relating to sex hygiene, suppression of vice and alcoholism in the vicinity of the camps is being carried on.

The Man-Power of our armies is thus being cared for.

Munition-Power is an even more complex problem. Munitions in the present war include every conceivable article of forage, equipment and armament which goes to make up the offensive or defensive strength of a fighting unit, from a reel of barbed wire to a locomotive, from a hand grenade to a 12-inch howitzer, from a bale of hay to an emergency ration. In a narrower sense it means rifles, guns, ammunition, aircraft. These are technical problems which have been entrusted to the best experts which our country affords.

Big guns require a long time to manufacture. Owing to the admirable industrial organization of France and Great Britain, in December last we were officially informed that their production of field, medium and heavy artillery had been established on so vast a scale that all American divisions which would arrive in France during 1918 could readily be equipped with the best type of British and French guns and howitzers.

It was proposed to us that in order to expedite and facilitate the equipment of the American Armies in France and secure the maximum development of the munition supply with a minimum strain upon available tonnage, French and British gun factories should supply our needs, and this was done without placing any undue burden on the French and British war industry.

However, we did not lag behind in bringing up to maximum production our own munition plants in this country. As an illustration, it may be cited that from the middle of August, 1914, to the middle of July, 1917, the British Government placed orders in this country for ammunition and ordnance of all kinds costing approximately $1,308,000,000. During the seven months ending December last we let contracts for 63,000,000 shells valued at nearly $1,000,000,000 and orders valued at nearly $1,500,000,000, for guns and munitions were placed.

Since our entrance into the war, the Ordnance Department has averaged 20 contracts a day with a daily expenditure of $6,000,000.

The achievements of the Aviation Section of the Signal Corps have been remarkable.

Last April the United States had practically no aviation resources, a negligible personnel and less than three hundred very second rate airplanes.

During the nine years since the first Wright machine had been successful (1908) up to 1917, less than $1,500,000 had been appropriated by the Government for Military Aviation. Then on July 24th last, Congress voted $640,000,000 for the Air Service; a total of $744,000,000 has been provided for the present fiscal year and $1,032,000,000 is being requested for next year.

When war came, our flying corps found hundreds of eager recruits from among the best type of our younger men. The training of aviators for our army was immediately undertaken. The production of suitable aircraft and airplane motors was intensively stimulated.

The Liberty motor was created. Standardization of construction was introduced and, whereas a year ago not a single good battle plane was being turned out in America, now we are producing battle types of the very latest design. By July we expect to have a goodly number in France.

It is regrettable that our air program should have been repeatedly so grossly exaggerated. In the press we have seen reports that 20,000 or even 100,000 American airplanes are soon to be at the front. As a matter of sober fact, on no single day since the outbreak of the war have either the Allies or the enemy been able to place more than 2,500 planes in the air. For each plane in the air there must be at least two replacement and two training planes, with two engines for each plane and according to the standard now

(*Concluded on page 322*)

Westinghouse

ELECTRIC MOTORS AND CONTROLLERS

Where Safety Depends on It

The supreme requirements of all mining apparatus are safety and dependability.

Every safeguard must be thrown about the man whose toil lays the foundation of all our national prosperity, by wresting from the earth the raw materials of manufactured products and the coal whose latent energy gives us power.

Even the little motor that drives a pump must not fall down on its job—for the safety of the miner is at stake.

It is a great confirmation of the sturdy dependability of Westinghouse Electric Motors that so many thousands are used in mines for pumping, hoisting, drilling, hauling (in mine locomotives) and in scores of other applications.

This is due also to the great extent of the Westinghouse line and the engineering ability which has devised motor characteristics and controllers to fit every possible industrial application.

Whatever the industry in which you are engaged, there may be undeveloped possibilities for electrical installations that will reduce operating costs, save fuel, conserve man power or in other ways contribute to a better product, a greater volume and a larger profit.

WESTINGHOUSE ELECTRIC & MANUFACTURING COMPANY
East Pittsburgh, Pa.

W
WESTINGHOUSE ELECTRIC

Waterman's Ideal Fountain Pen

$2.50, $4.00, $5.00 and up.

At the Best Stores.

Regular, Self-Filling and Safety Types

is the quality fountain pen inside and out, in both materials and workmanship.

Its years of faithful and convenient service, under any and all conditions, demonstrate its true economy.

Every soldier, sailor, nurse, airman and engineer needs a Waterman's Ideal in his outfit. Give them the best.

Waterman's Ideal is the highest development of Scientific Fountain Pen making and is recognized as such the world over.

L. E. Waterman Company, 191 Broadway, New York

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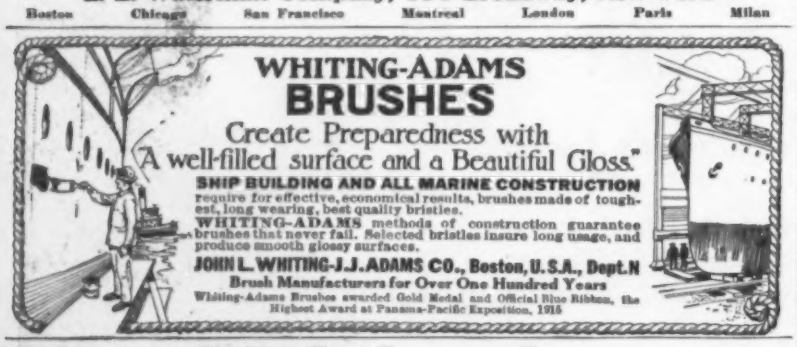

WHITING-ADAMS BRUSHES

Create Preparedness with "A well-filled surface and a Beautiful Gloss."

SHIP BUILDING AND ALL MARINE CONSTRUCTION require for effective, economical results, brushes made of toughest, long wearing, best quality bristles.

WHITING-ADAMS methods of construction guarantee brushes that never fail. Selected bristles insure long usage, and produce smooth glossy surfaces.

JOHN L. WHITING-J. J. ADAMS CO., Boston, U.S.A., Dept. N

Brush Manufacturers for Over One Hundred Years

Whiting-Adams Brushes awarded Gold Medal and Official Blue Ribbon, the Highest Award at Panama-Pacific Exposition, 1915

Chas. M. Schwab says—

in his book—"Succeeding with what you have"

"When we decide to build a new plant, the question isn't will it pay—But can we find the right man to manage it."

The demand for trained executives is always greater than the supply. The war is loudly accenting this need. When the physical struggle is ended and commercial reconstruction begins, ***trained executives who know*** will command almost any salary.

Chas. M. Schwab

And the man who prepares himself ***now*** with a sound understanding of business fundamentals is equipping himself with an asset that always commands a premium in the market for brains and business leadership.

The Modern Business Course and Service of the Alexander Hamilton Institute gives you a broad grasp and keen insight into the fundamentals underlying all business. It trains you in the first principles of all departments of Business.

It fits you to create new opportunities—it trains you to fill new responsibilities. It becomes an infallible guide in the selection of the right man for the right place. It increases your earning capacity. It establishes your organization methods and financial systems on a basis that ***never*** goes wrong because its conclusions are fundamentally ***right.***

The successful experience of thousands

The Modern Business Course and Service gives you, in easily readable, convenient form, the practical working experience, plans and analyses of thousands of successful business men. You can follow the Course in your leisure time and much that you learn—even from the first day you receive the Course—you can put into practice and profit by.

The kind of men enrolled

Among the 70,000 subscribers are such men as George M. Verity, President of the American Rolling Mills; E. R. Behrend, President of the Hammermill Paper Co.; N. A. Hawkins, Manager of Sales, Ford Motor Co.; William C. D'Arcy, President of the Associated Advertising Clubs of the World; Melville W. Mix, President of the Dodge Mfg. Co., and hundreds of other equally prominent, aggressive, efficient business leaders.

Get further information

Learn how your mental and financial business growth can be assured. A careful reading of our 112-page book, "Forging Ahead in Business," sent you free, will help measure what you know—what you don't know—and what you should know—to make success sure.

Mr. Schwab's statement that Big Business is always looking for capable executives should be a direct message to you.

Every man with either a business or a career to guide to bigger, surer success should read "Forging Ahead in Business." Simply fill out and send the coupon for a copy.

Alexander Hamilton Institute
74 Astor Place New York City

Send me "FORGING AHEAD IN BUSINESS"—Free

Name _____
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Business Address _____

Business Position _____

One Year of War

(Continued from page 320)

adopted in the West, 47 men on the ground. Consequently, if America adds 2,500 aviators and planes to the effective Allied strength in the air, we will have doubled their forces within the year.

I have given but a few salient features of our Munition-Power. Countless other activities could usefully be enumerated. Such an enumeration to be complete would have to include the entire economic resources of the country which have been placed unreservedly at the disposal of the War Department.

This hasty summary makes no pretense to completeness, there being, for example, no reference to the accomplishments of the Engineer Department, which, in themselves, would make an article of great interest; nor of specific Ordnance achievements, such as the Browning guns, the issue of rifles, and the like. Nor has space been given to the internal reorganization of the Department designed to bring about the most efficient workings of its machinery, ensuring independence of initiative to the American Expeditionary Force, and the effectice coördination of the work in this country; as, for example, the establishment of a War Council, or the more recent changes in the General Staff, which provide for five assistant chiefs, each responsible for the proper conduct of some part of the work of the military establishment.

During the past year our Man-Power and Munition-Power have been mobilized for war. Their full utilization on the field of battle depends on Tonnage-Power.

Our lines of communication are among the longest in the annals of war. The haul to the points of embarkation along the Atlantic seaboard over our congested railways is in itself a stupendous task. From here to our nearest base in France is well over three thousand sea miles. Our transports, arriving there, unload their cargoes. Then comes another journey of nearly six hundred miles over American rebuilt, American equipped railroads, operated by Army engineer troops, which brings our men, our munitions, our supplies to the battle field. How heavily can we tax our lines of communications? What tonnage will we have available? What percentage may fail to reach port because of hostile submarines? These are the uncertain factors of the situation. The best brains of the country have been called upon to find a way out.

In the meantime our transports are sailing. The number of our divisions in action is rising steadily. Supplies, munitions, men, are reaching the battle front in accordance with the plans outlined. The problems of Man-Power, Munition-Power, Tonnage-Power, are being vigorously attacked and, we hope, are in process of successful solution.

Naval Growth of a Year

(Continued from page 301)

especially to learn on how increased a scale naval operations as a whole are being carried out. Accordingly we present the following figures:

LATEST STATEMENT OF THE STRENGTH OF THE NAVY

	Enlisted Men	*Officers*	*Total*
Regular Navy	191,709	7,781	199,490
Naval Reserve force	78,195	10,033*	88,228
Marine Corps	38,512	1,434	39,946
National Naval Volunteers	15,000	822	15,822
Coast Guard	4,250	639	4,889
	327,666	20,709	
Total, officers and men			348,375

*Includes some officers enrolled in various branches of the reserve who have not yet been called into active service.

STRENGTH ON APRIL 6, 1917

Regular Navy	64,680	4,366	69,046
Marine Corps	13,266	426	13,692
	77,946	4,792	

STRENGTH OF AUXILIARY BRANCHES AT TIME THEY WERE CALLED INTO SERVICE AT BEGINNING OF WAR

Naval Reserve Force (approximately)	10,000
National Naval Volunteers (approximately)	9,000
Coast Guard	4,500

INCREASE SINCE WAR WAS DECLARED

Naval Reserve Force	78,000
National Naval Volunteers	6,800
Regular Navy	130,444
Marine Corps	26,254

The Hospital Corps has increased from 1,600 to over 8,000. The number of mechanics employed at Navy Yards has increased from 35,000 to over 66,000. There are also 7,000 other civilian employes at Navy Yards. Civilian employees in Navy Department have increased from 700 to 1,800; and 1,200 reservists are also on duty in the Department. There are now 1,397 midshipmen at the Naval Academy, Annapolis, Md. In the Naval service there are now approximately 350,000 officers and men, while there are more than 425,000 persons under the Naval establishment.

The total expenditures of the Navy from 1794 to 1916, under all heads are shown on page 610 of the Navy Year Book for 1916, to have been $3,367,160,591.77. How our naval expenses in connection with the present conflict compare with this figure is shown by the following summary:

Appropriations

Act of August 29, 1916	$312,888,060.25
Act of March 4, 1917	516,491,802.08
Act of June 15, 1917	514,805,033.87
Act of October 6, 1917	561,436,023.50
	$1,905,620,919.70

Appropriations Pending

Urgent Deficiency Bill	$66,321,672.00
Naval Appropriation Act	1,270,595,655.04
	$1,336,917,327.04
Also, in the pending Urgent Deficiency Appropriation Bill authority is contained to incur obligations to the extent of	$ 34,264,000.00
Total	$3,276,802,346.74

The total of appropriations made in August, 1916 for the fiscal year 1917, those made during last year and those now pending is therefore within $90,358,245 of the total expenditures of the Navy from 1794 to 1916, inclusive. And it must be said that additions will probably be made to the pending appropriations.

The Council of National Defense

(Continued from page 306)

in changing the design of the buildings from small one-story to large two-story barracks, not only through economy in material, but through economy in plumbing, paving, etc., which would have been necessary with the larger territory which the cantonments built of single story structures would have spread over. These two items at the most conservative estimates would mean a saving of more than $20,000,000.

The market price of aircraft spruce at the beginning of the war was about $200 per thousand feet. Through the work of the Aircraft Production Board in adjusting prices with the producers this figure was cut to $105 per thousand. Figured on the basis of last year's output of 30,000,000 feet, which is far below the amount which will be consumed during the current year, at the new price, this represents a saving to the Government and to the Allies of $2,850,000.

Through the action of the board a free exchange of all international patents was secured, and this country was thus enabled to use foreign designs without royalty. The royalties thus abolished would have amounted to from $400 to $600 on combat planes and from $300 to $500 on engines. It is not permissible to state how many machines of foreign design affected by this agreement are now being built, but the saving is large.

On preliminary training machines, which are the only kind of airplanes where a comparison can be made with production before the Aircraft Production Board was organized, a saving at the very start of $750 each on elementary training machines and of $900 on motors was secured through proper arrangement for production.

Applying Business to Government

There is likewise decidedly to be noted the saving to the Government of approximately $75,000,000 through the application by the Committee on Supplies of the Council, in the active charge of Charles Eisenman,

(Continued on page 324)

STENOGRAPHER--BANKER .. STOREKEEPER.. SECRETARY .. MINISTER .. DOCTOR .. WRITER .. FARMER .. MANUFACTURER .. PURCHASING AGENT

Let's All Save $51

The Oliver Typewriter Now $49—Formerly $100

ON this page we print a coupon which keeps $51 in your pocket. That is the war-time savings The Oliver Typewriter Company now offers you.

To save you half the former price of $100, we have instituted simplified selling plans. We no longer have an expensive force of 15,000 salesmen nor costly offices in 50 cities. And in other ways we have made vast economies in production and distribution.

Half Price Wins!

The $100 Oliver for $49 is so popular that our entire plant, devoted exclusively to the manufacture of new Olivers, is now being enlarged.

Sales are increasing enormously both to individuals and big concerns. Each day adds hundreds of Oliver users. Each day some great company sees the economy of the Oliver way. Over 600,000 Olivers have been sold.

Remember, we offer here perfectly new Olivers—latest models—never used. So do not confuse this offer—because of the price—with second-hand or rebuilt machines of an earlier model. If any typewriter is worth $100, it is this splendid, speedy Oliver Nine.

The Oliver Nine is our latest and best typewriter. It has all the wanted improvements. It is built of the finest materials.

It has a universal keyboard, so any typist may use it. And it has dozens of features not found elsewhere.

The Oliver Nine is preferred by many of the foremost concerns in the country, some of whom we list below. Its popularity is international.

Save $51

This $49 Oliver is our identical $100 machine—not a change, not the slightest cheapening. This is our $2,000,000 guarantee.

ALL of the savings in price come from our new and economical sales plans and increased production. We send you an Oliver for free trial. You are your own salesman. Try it for five days. Then if you want it, pay us at the rate of $3 per month. If you do not want to keep it, we will refund the transportation charges.

The Oliver Nine sells itself. YOU are the judge—no one need influence you. Merit must convince.

Used machines accepted in exchange at a fair valuation.

Free Trial

Note the two way coupon below. It brings you either an Oliver for free trial or our remarkable book entitled "The High Cost of Typewriters—The Reason and the Remedy."

This book explains how we are able to save you $51. With it we send a descriptive catalog.

Fill out the coupon now for either the free trial Oliver, or for our book.

If you buy one Oliver, you save $51. If you buy many, you save hundreds of dollars.

Send us the coupon today. It does not place you under obligation to buy.

Canadian Price, $62.65

THE OLIVER TYPEWRITER COMPANY
1304 Oliver Typewriter Bldg., Chicago, Ill.

The only reason we have been able to hold to a $49 price is our very large output. We hope to be able to maintain this price. Material and labor costs are increasing. We may be forced to raise. We do not wish to. We do not expect to. But we advise you to act now to be certain of getting your Oliver at the present price of $49.

* * * * * * * * * *

SOME OF THE FAMOUS USERS:

United States Steel Corporation
Baldwin Locomotive Works
Pennsylvania Railroad
Columbia Graphophone Company
Bethlehem Steel Company
National City Bank of New York
Hart, Schaffner & Marx
Otis Elevator Company
Diamond Match Company
New York Edison Company
Boston Elevated Railways
Morris & Co., Packers
Jones & Laughlin, etc., etc.

OVER 600,000 OLIVERS SOLD

THE OLIVER TYPEWRITER COMPANY,
1304 Oliver Typewriter Bldg., Chicago, Ill.

☐ Ship me a new Oliver Nine for five days' free inspection. If I keep it, I will pay $49 at the rate of $3 per month. The title to remain in you until fully paid for.

My shipping point is .....
This does not place me under any obligation to buy. If I choose to return the Oliver, I will ship it back at your expense at the end of five days.

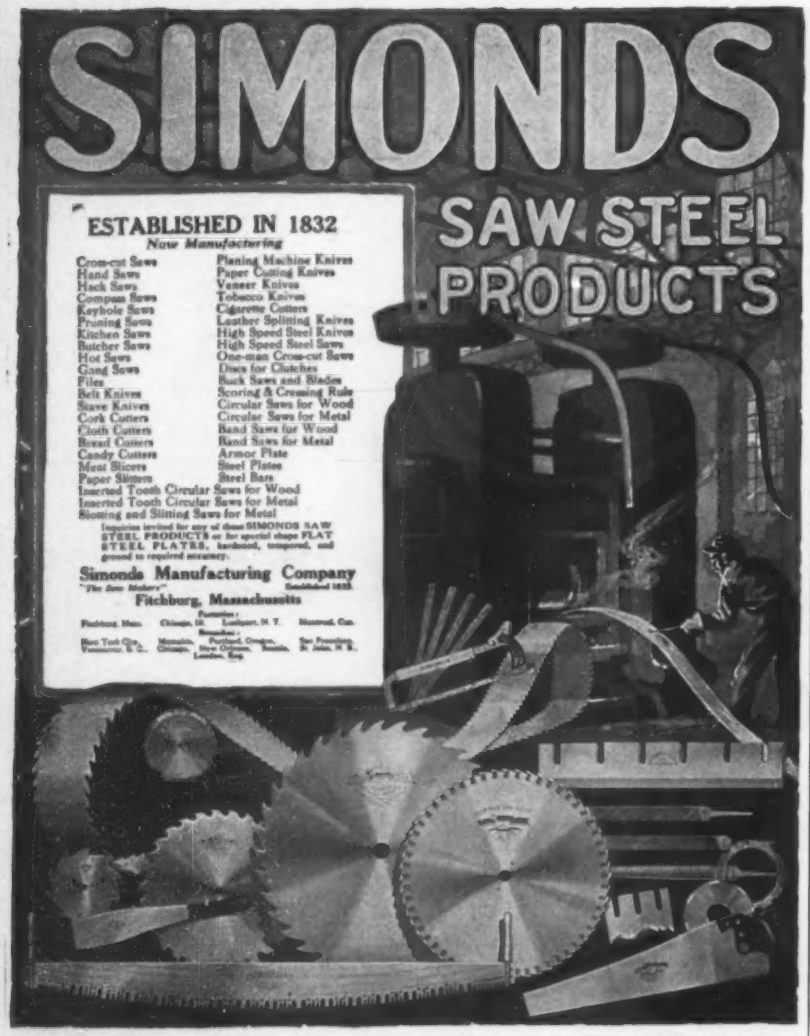
☐ Do not send a machine until I order it. Mail me your book—"The High Cost of Typewriters—The Reason and the Remedy," your de luxe catalog and further information.

Name.....

Street Address.....

City.....*State*.....

This Coupon Is Worth $51



MAZDA

"Not the name of a thing, but the mark of a service"

The new light that MAZDA Service throws on lamp-manufacturers' problems is reflected in brighter, whiter light that MAZDA Lamps give in your home

The Meaning of MAZDA

MAZDA is the trademark of a world-wide service to certain lamp manufacturers. Its purpose is to collect and select scientific and practical information concerning progress and developments in the art of incandescent lamp manufacturing and to distribute this information to the companies entitled to receive this Service. MAZDA Service is centered in the Research Laboratories of the General Electric Company at Schenectady, New York.

The mark MAZDA can appear only on lamps which meet the standards of MAZDA Service. It is thus an assurance of quality. This trademark is the property of the General Electric Company.

RESEARCH LABORATORIES OF GENERAL ELECTRIC COMPANY

4617

The Council of National Defense

(Continued from page 322)

of the most modern business methods in the purchase of supplies for the War and Navy departments, largely through the elimination of middlemen.

On shoes both the old method of awarding contracts under competitive bidding conditions, and the new method of awarding them at an upset price based on a definite estimate of cost, have been used. The two plans can therefore be easily compared.

By the plan of combining competitive bidding for part and fixed price for part, the Government has been saved $1,632,740 over the plan of strictly competitive bidding for the entire amount.

One of the general methods of saving on shoe contracts has been through securing options on leather and supplies, thereby preventing competition from sending up the prices of this raw material and thus increasing the prices of the finished shoes. The net saving to the Government through these options has amounted to more than $4,000,000.

Purchases of 3,124,998 yards of No. 4 duck of varying widths amounted in all to $4,089,150. These purchases, if made at commercial prices, would have cost $5,315,895, hence a saving of $1,226,745.

Through the Remount Committee of the Council approximate savings of $1,000,000 in purchases of oats have been made. By the efforts of this committee, further, grain elevators have been erected in the National Army cantonments at a cost of $16,000 each. When oats are handled in bulk a saving of 7 cents to 8 cents per bushel is made, and as the average cantonment handles about 110,000 bushels per month these elevators will pay for themselves in about two months, and after that there will be a saving to the Government of approximately $120,000 per month in the 16 cantonments. Through a coöperative agreement with the Canadian Government suggested by the Remount Committee, hay has been secured in Canada at about $10 a ton cheaper than in this country and compressed at cost by the Canadian Government at a saving of $4 a ton for compressing.

On one recent order alone of power driven machine tools $92,500, on 25 slotters, was saved from the price which the Government had been accustomed to pay. This was under the Machine Tools Section of the Finished Products Division of the Council.

Clearing Business for Action

The Commercial Economy Board of the Council, which is directed with great vision and energy by A. W. Shaw, with the coöperation of merchants, manufacturers and consumers at all points, has waged successful campaigns for conserving wheat, wool, and other commodities in which there have been shortages and for reducing the amount of labor employed on non-essential services in trade.

Through the work of this board, material, labor and capital in the shoe trade has been saved by the reduction of at least 40 per cent in the number of spring styles for 1918.

The total reduction in the number of men and vehicles employed in delivery by retail stores secured by the Commercial Economy Board ranges from 10 per cent to 50 per cent according to the locality. Thus possibly 15,000 men have been enabled to enter war work.

A saving in flour from the elimination of bread returns, effected by the Commercial Economy Board, is estimated by the Food Administration at 600,000 barrels per year.

The saving in wool cloth by the tailors to the trade through a reduction in the size of samples is more than 220,000 yards. For the entire garment and clothing industry the saving resulting from smaller samples will be not less than 1,500,000 yards. The saving in cloth that is resulting from the reduction in yardage per garment will probably amount to at least 35,000,000 yards this year. These activities were all under the Commercial Economy Board.

There may be further enumerated:

The completion of the inventory, for military purposes, of more than 20,000 leading American manufacturing plants.

The saving to the Government of millions of dollars by the proper coördination of purchases through the agency of the General Munitions Board of the Council of National Defense, this Board being later absorbed by the War Industries Board.

The mobilization of the 262,000 miles of railroads of the country for the Government's defense, at the instance of Daniel Willard, chairman of the Advisory Commission.

The close knit organization of the telephone and telegraph companies of America to insure to the Government the most rapid and efficient wire communications, under the leadership of Theodore N. Vail, reporting to Mr. Willard.

The creation under the Medical Section of the Council, of a General Medical Board headed by Dr. Franklin Martin, consisting of many of the most highly qualified surgeons and physicians of the country. The selection by the same section of thousands of doctors specifically qualified for membership in the Medical Officers' Reserve Corps, and the standardization, far on its way to completion, of surgical instruments and supplies.

The making available to the Government in an effective form the services of the engineering and educational professions, under the direction of Dr. Hollis Godfrey.

The settlement of the threatened railway strike early in March, 1917, through conferences in New York at which the Council was represented by two of its members, Secretary Lane and Secretary Wilson, and the Advisory Committeet by Daniel Wilard and Samuel Gompers, who were appointed a Committee of Four to deal with the controversy between the railroads brotherhoods and the railroad executives.

Creating the Liberty Motor

The creation by the Council of the Aircraft Production Board, which developed the Liberty Motor.

The results obtained by the Council's Committee on Coal Production in the procurement and expeditious shipment of coal, both in the civilian and federal interests—a story in itself.

The work performed by the Council's Committee on Emergency Construction and Contracts in enlisting the best building and architectural experts of the country for the erection of the cantonments for the National Army.

The successful initiation of a movement to coördinate activities on the part of the states of the Union for the national defense, brought to a clear and workable focus by a conference of states held in Washington at the call and under the auspices of the Council, this movement having reached a high point of organization under a special section headed by George F. Porter.

The organization of a railroad committee which was sent to Russia.

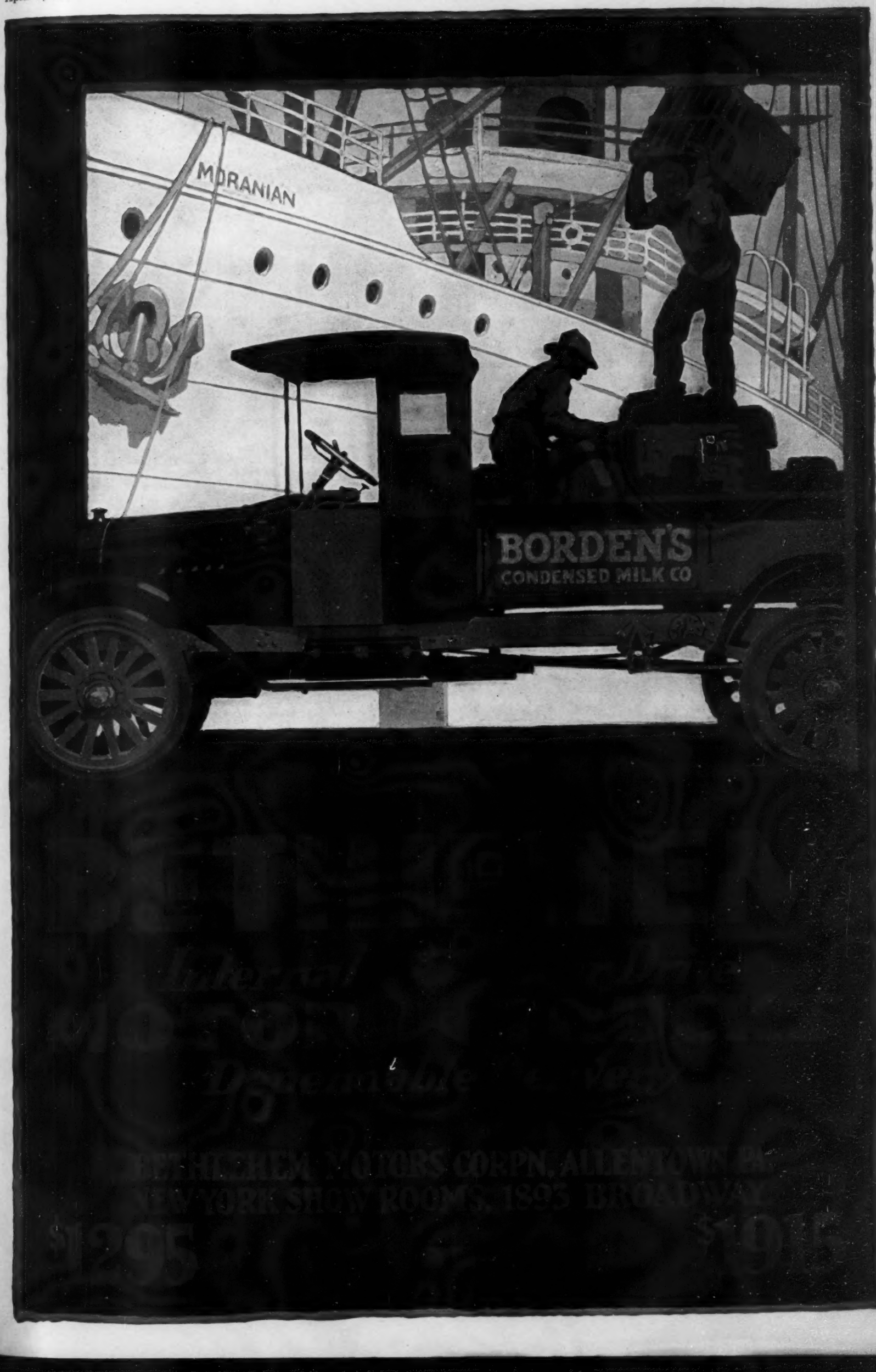
The enlistment of reserve engineer regiments to aid in rehabilitating the railroads of France.

The creation by the President, at the request of the Council, of a labor commission to aid in the adjustment of social and labor disturbances throughout the country, particularly in the western states.

The relatively general acceptance by labor and capital of the suggestion of the Council that existing labor standards should not be changed until the need for such action had been determined by the Council, with the steadying influence on industry growing out of such action. All the world knows of strikes that, for one reason or another, have occurred since we entered the war, but it is difficult to determine just what would have happened had not the Council made its promulgation. Samuel Gompers, whose powerful Americanism is questioned by nobody who knows him, heads the Council's labor committee.

The creation by the Council of a Woman's Committee, which is enlisting the woman power of America for the prosecution of the war and educating

(Continued on page 326)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The Council of National Defense

(Continued from page 324)

American women as to the causes of the conflict and the part they can bear.

The pronouncement by the Council through the Secretary of War, its chairman, of a policy to the effect that all effort should be centered to help win the war, this pronouncement having been made in response to queries as to the attitude which should be taken relative to improvements, public and otherwise, involving large construction work.

Evolving the War Truck

The creation, in little more than fifty days, through the Automotive Products Section of the Council and the Society of Automotive Engineers, in coöperation with the Quartermaster Department of the Army, of the standardized U. S. heavy-duty war truck. It is estimated that the Automotive Products section has saved $1,157,000 for the United States Government in its purchases of automotive apparatus. It is stated that France, with her many different makes of trucks, must keep on hand 2,000,000 repair parts. The U. S. standardized truck needs 7,500 parts.

The mobilization by the National Research Council, acting as the Department of Science and Research of the Council of National Defense, of the scientific forces of the country, this work extending into very valuable ramifications too many in number to be detailed here.

The work of the Committee on Inland Water Transportation in bringing together the companies engaged in inland water transportation, including those on the Great Lakes, in order better to meet the war situation and increase and make more efficient the freight carrying facilities of the country's waterways.

The work of the Storage Committee in coöperating with the five supply divisions of the Army in a study of the warehousing of supplies and of transportation as affecting storage policies. The location of storage areas, construction plans, methods of operation and the selection of a trained personnel have been features of this program. Similar services have been rendered to the Navy, Shipping Board and Fuel and Food Administrations.

In the last part of July, the activities of the Council, so far as they related to the production and purchasing of supplies and coördination with the purchasing departments of the Army and Navy, were consolidated in the War Industries Board, first headed by Frank A. Scott, formerly chairman of the General Munitions Board, and composed of Brigadier-General Palmer E. Pierce, representing the Army, Rear Admiral Frank F. Fletcher, representing the Navy, Robert S. Lovett, representing priorities, Bernard M. Baruch, representing raw materials, Robert S. Brookings, representing finished products, and Hugh Frayne representing labor. Mr. Scott was later succeeded by Daniel Willard, who recently resigned to take up again the active direction of the Baltimore and Ohio Railroad, of which he is the president. Mr. Willard was in turn succeeded by Bernard M. Baruch in the early part of March. This board has served as a clearing-house for the war needs of the Government, determining the most effective ways of meeting them, including the recommending of methods of increased production, the extension of industries demanded by emergencies and the sequence and relative urgency of the needs of the different government services. It has considered prime factors and the industrial and labor factors of the problems involved. So far as its powers have permitted, it has become a central directing agency for all production needs of the Government, stepping in where authorized to handle particularly difficult problems in which all of the executive departments were interested and preventing so far as it could conflicts in interest among them. To illustrate the volume of business transacted by the Priorities Committee, during November and December of 1917 about five hundred applications per day for priority were acted upon and approved and certificates issued. Since January 1st, the number has been about three hundred a day.

Organized under the War Industries Board, besides the raw materials and finished products divisions, is an industrial resources section the head of which is George N. Peek, and the duty of which is to deal with the transference of industry from peace to war work. There is also a Division of Statistics directed by Dr. Leonard P. Ayres, which has rendered valuable assistance, not only to the council but to several other of the war-making departments of the Government.

Other recent activities of the Council have included the formation of the Highways Transport Committee, Roy D. Chapin, chairman, which has been doing extremely useful work in developing the use of motor trucks for overland freight transportation, thus helping to relieve the congestion in the freight terminals.

Housing and the War

The Committee on Housing, Otto M. Eidlitz, chairman (the administration of this work has now been definitely assigned to the Department of Labor) during the autumn did pioneer work in mapping out a plan for handling the war housing problem; and its chairman has now been requested by the Secretary of Labor to direct the new war housing program.

An Industrial Service Section, headed by Prof. L. C. Marshall, was largely responsible for the initial plan for a unified labor administration which has since been referred by the President to the Department of Labor for that department to put into execution.

A good deal has been said about the various captains and lieutenants of industry who were called to Washington by the Council in the early days of the war and organized into committees under the Council. It would have been folly to have failed during these critical days to get the best thought and advice of the country's industrial leaders on the problems to be met whether or not there existed legislative authority for the steps which in the nation's interest had to be taken. Yet the presence of these men and the consequent apparent possibility of their doing business with their own companies gave rise to criticism which, while justified in theory, was not justified by the disclosures to date of any slightest irregularity on the part of any of these volunteer workers, than whom there has never been a more honorable and efficient company working for a nation in arms. It was the obvious and the elementary thing for the Council to call to its assistance the civilian executives whose business experience had given them a thorough grasp of the questions in hand. If the really big men in the industry were to be secured, obviously they must be men who were engaged in large affairs at the time. It was said during this period that the presence of these men in the Council's organization gave rise to opportunity for favoritism and personal gain. Certainly the arrangement was not ideal and no one in the Council considered it so, yet the task had to be done and someone had to be trusted to do it. The Council chose men whom it felt could be trusted and facts prove that its trust has not been abused. Throughout the law has been thoroughly complied with.

The Cost of the Job

The services of these experts have been contributed without cost to the Government; and it is significant that up to July 1st, 1917, after most of the terrific preliminary work of industrial mobilization and the tapping and energizing of new sources of supplies had been completed, the expenses of the Council had amounted to only the almost grotesquely small sum of $127,126.91. It certainly is not conceivable that any organization could have performed equal service at less cost. Even now the Council is asking for less than $1,000,000 for the forthcoming year and yet it is beyond peradventure one of the great and history making agencies of the American Government.

The initial work for which the industrial experts were summoned having been com-

(Concluded on page 328)

Gillette Safety Razor

Have You Seen the New Gillettes—Specially designed for the Fighting Man?

THESE models were designed by members of the Gillette Organization who have seen service with the Colors and know what the soldier is up against.

Hundreds of officers and men are buying them—the U. S. Service Set in metal case, and the new Khaki-covered sets for Uncle Sam's soldiers and officers.

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Feb. 15, 1918.

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Our President has just come back from the Wanden Plant, where you treated about 30,000 square feet of concrete with Lapidolith. He has requested the writer to inform you that the results are very gratifying.

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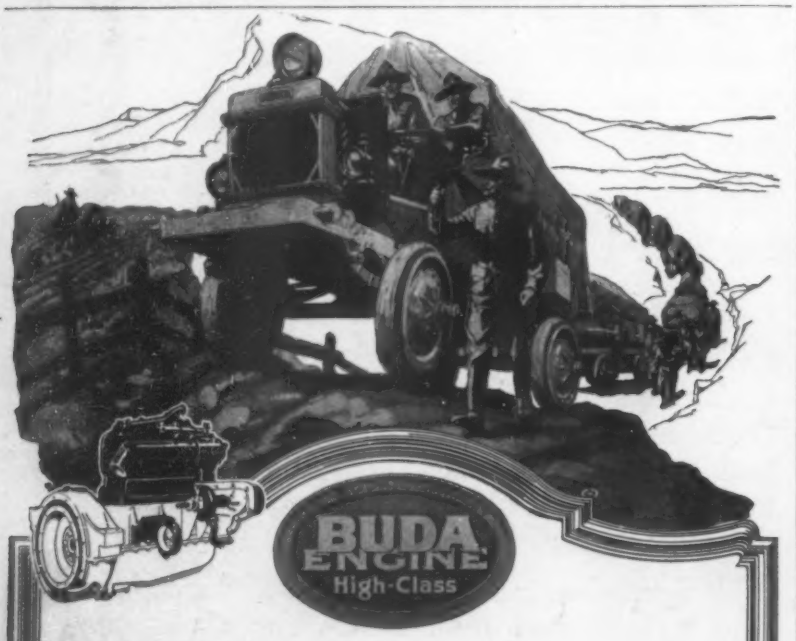

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THE BUDA ENGINE
"HIGH CLASS"

The Council of National Defense

(*Concluded from page 326*)

pleted, late in November the coöperative committees on industry of the Council were dissolved and war service committees formed through the instrumentality of the Chamber of Commerce of the United States, a body which had previously rendered valuable assistance to the Council, which are committees of business and not of government, and which yet serve, in effect, the same cardinal purpose of maintaining close and efficient relations between business and government.

Throughout the work of the Council and Advisory Commission, the director of both bodies has been Walter S. Gifford, one of the officers of the American Telephone and Telegraph Company, and before coming to Washington supervising director of the Committee on Industrial Preparedness of the Naval Consulting Board. This famous committee, which was the first motive agency to get the country to thinking about harnessing industry to government, was headed by Howard E. Coffin, and the writer was its third working head. Mr. Gifford has initiated many of the important things done by the Council, of which he is the chief administrative unit.

It should, of course, be said that the Council itself consists of the Secretaries of War, Navy, Interior, Agriculture, Commerce, and Labor. The members of the Advisory Commission, whose chairman is Daniel Willard, are Howard E. Coffin, Julius Rosenwald, Bernard M. Baruch, Dr. Hollis Godfrey, Samuel Gompers, and Dr. Franklin Martin.

Thus, in broad strokes, I have endeavored to indicate and to interpret the duties, the reason for existence, and the accomplishments of the Council of National Defense throughout the first year of America's participation in the war against the Imperial German Government and the Central Powers. Even history, with its detached perspective which we cannot now achieve, is, as somebody has said, only one man's opinion, just as Emereson wrote that the law is only a memorandum. Hence, in the foregoing, it has seemed best for the most part to state the facts without exaggeration and with no sense whatever of special pleading, as a slight record of great days crowded with high purpose and uncomplaining toil on the part of many of the finest and truest minds of America.

The Fuel Question

(*Continued from page 307*)

relieve the coal situation as it existed in January was undeniably drastic. The order of January 17th, suspending, temporarily, the operation of industrial plants in portions of the United States was the only available and adequate remedy for existing troubles.

The number of vessels waiting for bunker coal in our harbors was increasing week by week until, at the time of the issuance of the order, the total was appallingly large, especially so when one reflects upon the necessity of an immediate and constant contact between armies in the field and the base of supplies. Enormous stores of things essential to the war were piled high on our docks and in our store houses awaiting transportation. Coal to bunker the ships was held back by traffic congestion. The result of the closing order was that 480 ships laden with immense stores of food, fuel, munitions and other war supplies, were bunkered and sent on their way, between January 17th and 29th, inclusive. Within that time all of the ships ready to sail were bunkered and the line between our shores and the armies in the field had been reestablished.

It is needless to say that the coal exclusion order had been planned well in advance of its announcement. The exemptions that followed were part of the original plan, and each and every company exempted was listed at the request of department heads, especially the Secretary of War, the Secretary of the Navy, and the Chairman of the Shipping Board.

While the order had the effect of conserving coal, it was not designed primarily for that purpose, but as pointed out at the time, its main purpose was to break up the congestion of freight and to permit transportation to become normal. The operation of the order fully justified its enforcement. Little or no thought was given to the financial bearing the ruling would have on the industries involved. When a nation is at war the first thought must be of people not of profits. The remedy had to be applied. There was no other way.

There has been no coal shortage measured by normal times. The shortage of 50,000,000 tons for the year is measured by war conditions. The bituminous mines produced, in 1916, 502,000,000 tons. That was, up to that time, the record year of coal production. The production for eleven months of 1917 was 503,000,000 tons. It was anticipated that the production would reach 50,000,000 tons in December, but less than that was mined and shipped. The increase of production of 1917 over 1916 was about ten per cent, which was not enough by half.

The anthracite production for 1917 was from eighty-one to eighty-three million tons, an increase of from eleven to thirteen million tons over the preceding year.

Seventy-five per cent of anthracite coal is utilized by domestic sonsumers. About twenty-five per cent of bituminous coal goes into domestic consumption, including that used for public utilities supplying light and heat.

When we compare our ills with those suffered by other countries engaged in war we may congratulate ourselves upon our escape from real hardship and privation; when we match our efficiency against that of our chief antagonist in the war—prone to boast of her efficiency—we need feel no sense of humiliation.

Our coal supply has been above normal since our entry into the war; our movement of coal has been above normal. The prices maintained have, since the President's order fixing prices, been within reach of all coal users, large and small, rich and poor. Our fuel troubles have been of temporary duration; those of others have been prolonged.

My attention has been called to a report of a debate on the coal situation in the German Reichstag, in which various members participated. The disclosures there made show that long preparation for the war did not suffice to provide perfect—even satisfactory—supply or distribution of coal. Sentiments such as the following were expressed: "The industry has entirely failed"; "what is the matter with the forwarding and transportation?" "the promises of the Coal Commissioner are not being fulfilled"; "the big dealers must be forced to deliver to the community"; "the factories complain that the delivery is irregular"; "certain country communities which have wood are being swamped with coal; others lack both coal and wood."

In Germany, as in the United States, "the production possibilities are not so unfavorable," but "there is a greater scarcity of freight cars than usual, and this causes delays in delivery."

While our war production has shown a material increase over normal theirs is behind that of peace times. In Berlin "public utilities of the city lead a hand-to-mouth existence," and "the domestic need is now greater than in peace times."

In Germany, as in the United States, the seat of the trouble is transportation. Here, the transportation difficulty may be charged chiefly to an insufficient number of locomotives. While 5,000 new locomotives are needed on our railroads each year, only 2,585 were supplied during the year 1917. Foreign countries, principally France and Russia, were supplied with 2,861 locomotives from our factories during the year. Not only that, a large number of locomotives in service on our railroads were taken from our tracks and put into service in Russia and France. Instead of having our motive power increased at a time when traffic requirements were heaviest, it was actually decreased.

While the Fuel Administration has been operating with a definite plan and program, much of its time, as has been shown, has been applied to the adjustment of local difficulties that could not wait. We have

(*Concluded on page 330*)

Mack TRUCKS

National Needs

The need of ships to carry supplies and men to the fighting line in France is imperative. So also is the need of trucks to carry material to the seaboard—and to take up the burden back of the trenches.

Mack trucks are carrying huge loads to the great Atlantic docks. More Mack trucks are proving themselves indispensible in France.

The rugged strength and elephantine power make the selection of the Mack natural for transporting heavy castings and other ponderous loads. In both material and design, the Mack is the embodiment of strength, power and stamina.

Mack trucks are made in capacities 1 to 7½ tons—with trailers 15 tons.

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The Fuel Question

(*Concluded from page 328*)

kept constantly in mind the three objectives that the Congress wrote into the Act authorizing governmental control over the coal industry: to increase production; to simplify transportation and to stabilize prices.

The machinery to carry out these objects is now in running order. Besides the central administration in Washington the organization extends to every state, to the District of Columbia and to Cuba. The state's organizations reach into the counties and the communities, so that, in every section where coal is mined or consumed, a relation is established with the United States Fuel Administration.

Two or three simple facts should be borne in mind. Our supply of coal is practically inexhaustible. But not enough of it can be moved away from the mines to supply the present-day needs of the consumers. It became, therefore, essential that authority should be lodged in some governmental organ to superintend the distribution. It was for the purpose of assuring to the people an equitable distribution of a limited product at reasonable prices that the United States Fuel Administration was given life.

Motor Trucks in the Great War

(*Concluded from page 308*)

the magnitude of the undertaking, motor truck deliveries are far in excess of shipping capacity.

In the year 1918 there must be delivered about a hundred thousand motor trucks for our army in France. These, with repairs, will have a value close to $400,000,000. To appreciate what this means one has only to realize that the aggregate output of motor trucks in the whole country for the year 1917 was not over $270,000,00. To accomplish the task before us many passenger-car producers have given up regular production, and converted their plants to the making of trucks or truck parts.

The most difficult of all the methods of truck production was that used by the Quartermaster Department. But this method has achieved the most democratic result from the standpoint of industry and government, and the best from the military view; so it may be of interest to learn why it was undertaken and how accomplished.

The Argument for Standard Trucks

The great value of a standard military truck lies in the matter of repairs and maintenance. In the army of one of the Allies there are so many models that if a truck of one department should break down before the repair station of another department, it would be helpless. In the same army there are four standards of pneumatic tires and no end of sizes. The supply of tires for this army is so involved that it takes seven times the number to keep it going that would be necessary if the models were standardized or if the designs of trucks were coördinated. The problem of repair has been so severe that in some engagements the number of effective trucks has fallen as low as 25 per cent, while it is seldom possible to keep more than 60 per cent going at one time. Military efficiency has demanded great care in the interchangeability of guns and ammunition. But the war came so quickly that few countries were prepared with a truck having this cardinal military advantage. Many efforts have been made to solve the problem among the armies of the Allies, and already a degree of partial interchangeability has been secured.

The standard military truck of the American forces has been developed by the Quartermaster Department for the purpose of meeting all the requirements of military service. The army had the assistance of the Society of Automotive Engineers, now one of the great engineering bodies of the world, which assembled 50 experts from among its members. These were divided into eight groups, charged, respectively, with the development of engine, transmission and clutch, axles, chassis, electrical system, springs, radiator and cooling system, and

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"The Management of Your Estate" is a twenty-page booklet describing the services performed by this company. It will interest every man who is giving thought to the safeguarding of his business interests while in the service of his country. We will gladly mail you a copy upon request. Further details will be cheerfully given by the officials of this company at our main office or at either of our uptown branches.

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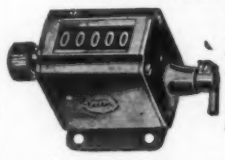
Capital and Surplus, $8,500,000.

Eliminate "Slacker" Machines

Every type of machine has its *standard* production-rate, and any lesser production is an economic loss to the nation and a direct loss to the owner.

You can find this standard for *your* machines—you can keep each one speeded up to full duty—if you'll check up the output with

Veeder COUNTERS



The Set-Back Counter at left registers one for each revolution of a shaft, recording an operation. Reset to zero by turning knob. Price, $3.00

Veeder Counters, in one model or another, meet every need in developing or operating machinery. Booklet?

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It is a composition material, easily applied in plastic form over old or new wood, iron, concrete or other solid foundation—Laid 3-8 to 1-2 in. thick—Does not crack, peel or come loose from foundation.

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miscellaneous parts. A chairman was designated for each group, and the fundamentals laid down in the general specifications issued by the Quartermaster Corps in the spring of 1917 were used throughout as a guide.

Each group laid out its unit to accomplish the best results possible from the specifications. So completely unselfish were the contributions of the members that there were incorporated valuable features which had been intended, by the several compaines represented, for use as the basis of future sales. The idea on which the divisions worked was to produce the most reliable truck possible, and preference was accordingly to be given to all points in which greatest reliability was certain. Thus, while the truck was designed to give the best economy possible, it was deemed of greater importance that the motor be one that would run with certainty on the worst fuel possible. Above all it was considered of surpassing importance to have a truck of great going ability. This meant a truck that could meet with ease heavy grades and bad going, and that would display conspicuous ability to get over soft ground.

Creating the "Liberty Truck"

After spending the month of August in discussion on design and the various elements which enter into the making of a truck, the various groups started to lay out the Class B design on September 1st. This truck, while rated at three and a half tons, was to be built to take a load of five tons. A schedule committee was formed, consisting of the chairman of each of the parts groups and officers of the Quartermaster Corps. Starting September 1st, the drawings of all parts were to be done by the 10th, all the parts were to be completed by October 1st, and the two sample trucks were to be run on their own power by October 10th.

The performance on this trying schedule was one of the finest mechanical achievements of the war. On September 10th the drawings were practically completed and many of the dies and patterns begun. On September 28th the first motors were running and the great majority of parts completed. The assemblers of the trucks received their parts about October 1st, and on the 8th the trucks were making short test runs. Two days later the trucks started for Washington—one from Lima, Ohio, the other from Rochester, N. Y. They came through without developing any mechanical defects, and one of them accomplished its journey without the use of a wrench. On October 19th they were formally delivered and accepted by the Secretary of War in a very impressive ceremony. They were afterwards presented for inspection by President Wilson, who expressed great admiration for the speed of delivery and the results.

Many interesting obstacles were overcome in turning out these standard trucks. The pattern for the crank case was produced in seven days, although a job which usually takes from three weeks to a month. The cylinder pattern, the making of which ordinarily requires over three weeks, was likewise completed in five days. The crank-shaft dies were sunk in seven days, although this operation usually requires three weeks. During the time these jobs were under way there was such congestion in the express service that many parts were delayed or lost in transit. One company's purchasing agent carried crank-shafts in his Pullman car so as to be certain of delivery.

The schedule committee laid down the month of January as the time when production must commence. On January 17th, at the annual banquet of the Society of Automotive Engineers, word was received that the first five trucks were that day completed. By May 1st the trucks will be in production of over a thousand per month, and this figure will rapidly increase until a rate is attained of over 60,000 per year.

Since the delivery of the first samples of the Class B truck, Class A 1½-ton and Class AA ¾-ton trucks have been designed, completed and delivered in Washington. These trucks and many of the parts therefore were completed in even shorter time than that taken by the Class B truck. The smaller trucks follow closely the design of the larger model. These trucks can be considered the last word in design and efficiency for military purposes. As an illustration of what has been attained, the engines develop over ten per cent more power at normal speeds than present models, while they have ten per cent greater economy.

The army had the assistance of the Automotive Products Section of the War Industries Board. Through the agency of this board, the resources of the industry were brought to the aid of the government with the utmost rapidity. After the design of the Class B truck was well under way, the Military Truck Committee was formed as part of the Automotive Products Section. This Committee laid the foundation of the section which has charge of the production of military trucks, passenger cars, motorcycles, etc., under the Quartermaster Department.

Few contributions to the art of war ever attained importance in the pursuits of peace. It can, however, be said that these trucks have already had a profound effect on the design and requirements of commercial trucks, and that they are considered by authorities to be notable contributions to the art of motor transportation. Out of the discussion as to how to test this engine and this truck came the system of driving the trucks to the seacoast, thus training the crews, testing the trucks, and relieving the freight congestion, all at one blow. Inseparable from this activity is the great contribution that the motor truck is making toward the solution of our railroad problem in this country, by means of highway transportation. Military roads will soon be a fact; motor trucks will be our main defense.

The Government and the Railroads

(*Concluded from page 315*)

Just how much it should be discontinued or diminished, and what economies can be effected by the discontinuance or consolidation of numerous other railroad business activities, such as freight and passenger ticket agencies, offices and officers, are matters which will come up for decision in the near future.

Avoiding duplications of service; unification of purchases, either for the entire country or for sections; standardization of locomotives, cars and shop practices; curtailment of operating expenses; these and kindred subjects are all matters which have been put in competent hands for investigation. No move not mandatory for a pressing need—such as the embargo noticed above—will be made without due consideration of all sides of the question. The Director General feels very strongly that both railroads and public will respond the better to the unavoidable inconveniences and hardships, if they believe that government control is being exercised intelligently, carefully, and as Lucretia Mott would say, with "Truth for Authority, not Authority for Truth." To this end the Director General has sought to put the innumerable problems which press for immediate solution in the most competent hands, while reserving to himself the authority—and accepting the responsibility—which the President's order lays upon his shoulders.

So far as it is possible for one man to do, the government control of railroads is being exercised with but one thought in mind—that America's safety, America's ideals, America's rights are at stake. Democracy and liberty throughout the world depend upon America's valor, America's strength, America's fighting power and America's transportation system. We can win and save the world from despotism and bondage only if we pull together. We cannot pull apart without ditching the train. Let us go forward with unshakable purpose to do our part superlatively. Then shall we save America, restore peace to a distracted world and gain for ourselves the coveted distintcion and just reward of patriotic service nobly done.

2 Ton Warner Trailer used with 2½ ton truck by Merchants Transfer Co.

900,000 Tons of Hauling Power Lost by Motor Trucks Each Day

Warner Trailers Utilize This Wasted Power

Transportation authorities agree that, in America, a minimum of 900,000 tons daily are moved by motor trucks. And power sufficient to move an equal tonnage is permitted to go to waste.

All good motor trucks develop an excess of power. When loaded to rated capacity, they can easily pull another load at least equal to the one they carry. When the truck is used alone this power is lost. But with Warner Trailers, motor trucks work at full capacity. And the cost of operating truck and trailer together is only slightly above that of running the truck alone. This, with a far more efficient method of hauling.

Your Truck Driver Operates the Warner Trailer

With Warner Trailers, hauling costs show a gratifying decrease. The three greatest items of expense—labor, motor upkeep and gasoline—are cut in half.

Hitching and unhitching the trailers is a simple matter. One man—the driver—does this in a minute's time. And Warner Trailers follow the trucks without further attention.

Built Like a Motor Truck

Warner Trailers are of sturdiest construction throughout. Built like a motor truck minus the power plant.

WARNER HEAVY DUTY TRUCK TRAILERS TWO AND FOUR WHEEL TYPES

Don't confuse the Warner Trailer with a wagon simply because it trails. This is a high speed, mechanically correct appliance. Many exclusive features increase efficiency. Warner Trailers follow the trucks around corners, into alleys or narrow loading spaces. Reversible so they can be hitched or steered from either end. Easily backed.

Other advantages

Warner Trailers not only cut hauling costs, but they offer a far speedier delivery service than is possible with trucks alone. One instance of this: The Warner Trailer can be dropped at one point for unloading, the truck proceed to another to discharge its own load and the empty trailer be picked up on the return trip. This keeps the power plant working almost continually. In countless other ways, Warner Trailers make for economical, efficient delivery service.

Endorsed by Big Business

America's largest manufacturers are users of Warner Trailers. These concerns did not adopt them on unsubstantiated claims or without investigation. Their transportation engineers made a thorough study of Warner Trailers and their value in solving hauling problems.

A similar investigation will benefit you. We have more interesting facts on trailer hauling to lay before you. Write to us today for further information.

Warner Manufacturing Co.

109 Bushnell Ave. **Beloit, Wis.**

Inter-City Freight in the future will be largely handled by motor. Warner Trailers make possible the truck trains necessary to such service.

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Keeping the house supplied with water from a nearby well was one of the numerous tasks W. L. Douglas was called upon to perform while "bound out" pegging shoes, at the age of seven.

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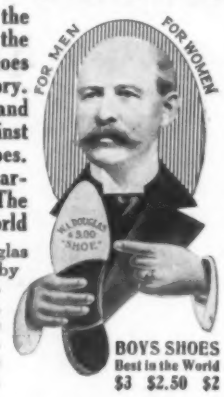

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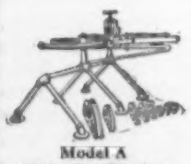

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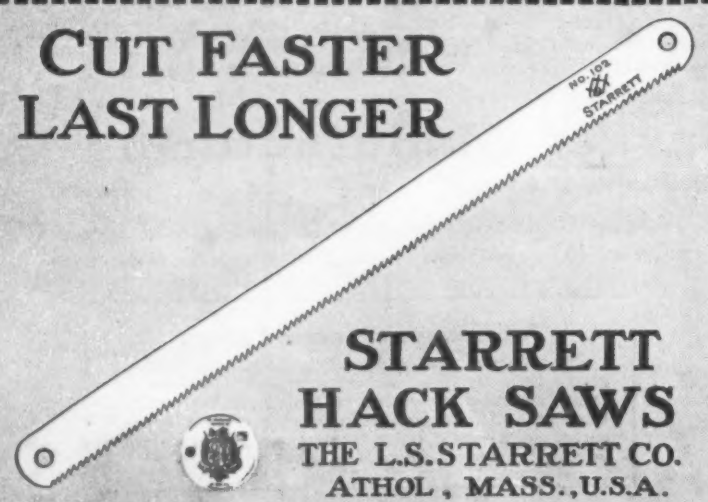

STARRETT HACK SAWS
THE L.S.STARRETT CO.
ATHOL, MASS., U.S.A.

The German Long-Range Gun

(Concluded from page 309)

with the 10-inch gun it would have been possible, had it been put to the extreme test, to secure the calculated maximum muzzle velocity of 4,000 feet per second.

Judged as a problem of construction, we do not hesitate to say that a wire-wound gun could be built that would throw a 9½-inch shell for a distance of 70 miles or more. In the case of the 45-caliber Brown, wire-bound gun it would have been sufficient to enlarge the powder chamber, increase the number of wire windings; lengthen the gun from 45 to, say, 75 calibers; stiffen it against drooping by means of a steel truss or a vertical plate girder below the gun, and then provide a powder that would give the necessary mean pressure to develop the required muzzle velocity.

That the artillerists of the Allied powers have understood perfectly well the possibility of building guns of range equal to and greatly exceeding that of this German gun, is shown by reference to an article published in the SCIENTIFIC AMERICAN of April 8th, 1916, which was written for us by Major (now Colonel) Alston Hamilton of the Coast Artillery Corps. The article is entitled "A Study of the Theoretical as Distinguished from the Useful Ranges of Modern Artillery." The tables and diagrams will possess particular interest just now, especially those showing the ranges, the heights of the trajectories, and the time of flight of projectiles if they were fired in vacuo—that is to say, if there were no air resistance. We are told that, with 4,000 feet per second muzzle velocity, without air resistance, an infantry bullet of whatever weight or form, with 45 degrees elevation of the gun, would shoot 94 miles—or from New York to Philadelphia—would rise 24 miles into the air, and would occupy a little less than three minutes in making the journey. Moreover, however big the gun, its projectile would travel just exactly the same distance, would rise to exactly the same height, and take the same time in flight. A table in that article which is of pertinent interest just now, is one showing the possible ranges of shells when fired through the atmosphere under existing conditions. It shows that, with 4,000 foot-seconds velocity, a 10-inch shell would travel 63 miles; and that, with the same velocity, a 16-inch projectile would be thrown 85 miles.

Speaking of the diminished air resistance at heights of 20 miles and over, to which such projectiles would rise, Colonel Hamilton points out that the air resistance is proportional to the density of the air, and if the density of the air is diminished, the resistance of the air is proportionately reduced. Due to great increase in muzzle velocities and to the reduction of the resistance of the air by improvement in the form of the projectile, it is now possible with large angular elevations to throw the projectile to very great heights as it describes its trajectory. The air, as is well known, becomes rarer as the height above the earth's surface increases. More than half of the entire atmosphere lies below a height of four miles, and nine-tenths of it within 10 miles. Calculation shows that when, in describing its trajectory a projectile ascends to a maximum height of six miles, the average air resistance in the trajectory is reduced one-half, and that when the maximum height is 12 miles the average air resistance in the trajectory is only one-forth of what it is at the surface of the earth.

For such an extreme trajectory as one with a maximum height of 12 miles the mean resistance is therefore only about one tenth part of what it would have been for a projectile of the old pattern with a flat trajectory. Modern construction has made possible a trajectory in which the resistance no longer precludes a close approach to the trajectory of unresisted motion.

The conditions of attainment of such ranges are exceptional; and for other elevations and lower velocities, such as are usual in practice, the range in air is seldom more than half of that for un-

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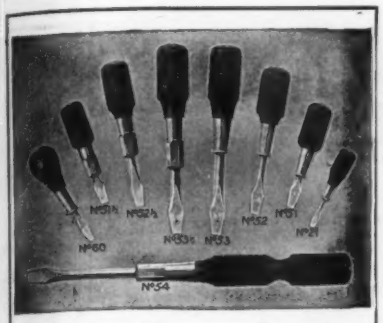

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Blade, Shank and Head—one piece of special steel, finely tempered. The Blade cannot turn in the Handle.

The Assortment illustrated above is well worth your attention.

For instance—No. 21 shown at the extreme right of the picture—blade only 1½ inches long, just fits the vest pocket, a strong little Driver and very handy.

Also No. 60—shown at the left—only 1⅝ inch blade but with a big sure grip handle. For heavy work into close corners it cannot be beaten. Used by Plumbers, Machinists, Millwrights, etc.

Nos. 51, 52 and 53—Called MACHINISTS' DRIVERS—big, broad tips for large screws and extra large shanks for heavy work.

Nos. 51½, 52½ and 53½—also Machinists' Drivers, have hexagon nut on shank for use with a wrench.

No. 54—Note the DOUBLE GRIP, also the hexagon feature for wrench. With this latter Driver one can turn anything.

We make many other drivers. See Catalog No. 34.

STANLEY RULE & LEVEL CO.
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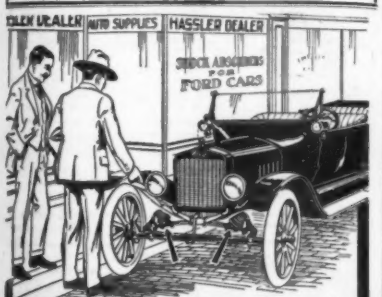

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resisted motion with the same elevation and muzzle velocity.

There are several reasons for not attempting to realize in practice the full ranging possibilities referred to above. In the first place, what is called *erosion* is a great obstacle to the practical attainment of very high velocities. Erosion consists in the wearing away of the rifling of the gun due to the great amount of heat and the high pressures inseparable from the attainment of great velocities. Erosion is more troublesome in large guns than in small ones. Even with velocities in common use, guns are often relined, or have the interior of the gun renewed; and this is a process which consumes time. It is to be expected, however, that science will eventually find a remedy or even a preventive for this troublesome disease of guns.

A second consideration limiting the practical ranges of guns lies in the fact that at sea and on the seacoast, where the largest and most powerful guns are used, the curvature of the earth actually hides the enemy at extreme ranges, such as those referred to above. The scattering of the shots at such ranges would make the chance of hitting far less than one in a hundred.

Distilling Municipal Gas from Wood

BEFORE the General Assembly of Swiss Gasmakers, the Director of the Gas Works at Perusa, Italy, gave an interesting account of the use of oak instead of coal or lignite for the raw material for furnishing the city with gas. The Perusa plant was built in 1912 with a capacity of 4,000 cubic meters per 24 hours, and was designed to permit the use as fuel of the lignite found nearby.

Because of the coal crisis in Italy the Director found himself obliged to distil this lignite instead of coal, and finally to fall back upon oak wood in which the neighborhood is very rich. In April, 1916, he began by distilling four parts of charcoal with one part of wood, as is a common practice in some parts of France. By the latter part of May, however, he had begun to use very dry wood alone; he could dispose of about 6,000 kilograms of this per 24 hours. The furnaces are also fired exclusively with wood, the consumption being about 1,800 kilograms per 24 hours; the ashes form a by-product which finds a ready sale.

The duration of the distillation, the temperature being practically the same as for the distillation of coal, varies from two to three hours, according to the size of the blocks. Each retort holds 200 kilograms of these; charging is accomplished by pushing in with a stick the round billets previously arranged in a sheet iron gutter.

For fear of the accidental deadening of the fire, it was not found possible to construct extinguishers for the wood charcoal, which is incandescent on its issue from the retorts; the extinction, which like that of coke, is accomplished by sprinkling with water, gives a very damp charcoal, containing 30 per cent of water, and broken into small pieces. About 2.5 per cent of the wood distilled is recovered in this form; as it is very compact and very hard, the debris of dust is scarcely more than 20 per cent.

Contrary to the advice given by Reissig in his work on the distillation of wood it was not found feasible to cool the drum suddenly, for fear of the hardening of the tar. Experiment led to the adding of just sufficient water to replace that lost by evaporation, and the temperature of the gas at issue varies from eighty-five to ninety-five degrees Centigrade. Under these conditions the tar of the drum, though very viscous and sticky, will follow the gas as far as the entrance of the tubular water condenser in which the temperature varies between sixty-five and eighty-eight degrees Centigrade; it flows, with the tar retained by the said condenser, into a siphon, which it has been found necessary to make shorter. Eliminating the 15 per cent of water contained by this tar, there remains a sort of pitch employable in naval constructions.

The gas is then cooled suddenly in an air condenser, in which a second tar is

Steel is the Foundation of Industry—save it

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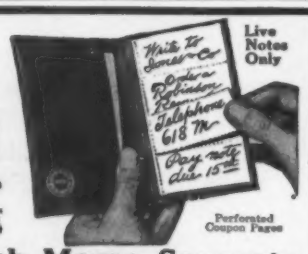

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NEW BOOKS, ETC.

THE BOOK OF CORN COOKERY. By Mrs. Mary L. Wade. Chicago: A. C. McClurg & Co., 1917. 8vo.; 115 pp. Price, 75 cents.

Mrs. Wade, in compiling this book to show our housewives how best to utilize "the American Indian's greatest gift to modern civilization," has done more than merely to bring together recipes for a richly varied menu, good as these are; she imparts some knowledge concerning the origin, nutritive value, and digestibility of corn, and performs a service to the food conservation movement by placing within reach of the home caterer a true economy that "comes from a wider knowledge and viewpoint; not from a parsimonious spirit."

THE BOOK OF THE WEST INDIES. By A. Hyatt Verrill. New York: E. P. Dutton & Co. 12mo.; 458 pp.; illustrated. Price, $2.50 net.

The author's acquaintance with this one-time happy hunting ground of the sea-rover and the buccaneer extends over a period of twenty-five years, as traveler, explorer, and occasional resident; his thorough familiarity with both past and present conditions is at once apparent. The natural features of the islands, marked by tropical generosity, form the background for a population decidedly Asiatic in tone; the *ensemble*, as seen through the eyes of an authority, constitutes a work the fascination of which is increased by pen and ink sketches and fine photo-engravings. Those who travel in mind only may use it as the vehicle for a fascinating journey, while the tourist will find its maps, its glossary, and its fund of general information most welcome. It fulfils the promise of its sub-title, and is a guide book, history, and general description in one.

AMERICA AT WAR. By Professor W. F. Osborne, University of Manitoba. New York: George H. Doran Company, 1917. 8vo.; 196 pp. Price, $1 net.

To see ourselves as others see us is often beneficial in more ways than one; in this case it is a well-known Canadian that has visited us, filming with remarkable definition his observations and impressions. To him, the outstanding features of our preparation for war are our capacity for organized effort on a huge scale, and the spectacle of a hundred million free citizens throwing themselves into a desperate struggle for ideals with no thought of ulterior advantage. He encourages us to believe that this war will prove the real melting-pot that shall unify the diverse nationalities making up our conglomerate population, and he sees selective conscription as a long step toward that end. The British and French delegates are sketched at close range; there are shrewd, critical appraisals of President Wilson, Roosevelt, and lesser lights, and a dramatic report of Champ Clark's speech opposing the President and conscription. Conversational, journalistic in the better sense, this narrative of an unprejudiced eye-witness gives one a sense of participation in the stirring events of last April and May, resulting in a more comprehensive view of their significance.

GRAVITATION. Discovery of Its Cause and Mechanism. By H. Jamyn Brooks. Bristol, England: J. W. Arrowsmith, Ltd. 1917. 12mo.; 48 pp.; illustrated. Price, 1s. net.

In this pamphlet we are given a new theory of gravitation. Whatever may be the nature of the earth's interior it is certain, says the author, that a process akin to combustion is there constantly at work; hence there must be an up-draught of "ethers and gasses," and this must result in a corresponding down-pressure on the crust of the earth. This condition he believes gives us an adequate explanation of the "attraction" of gravitation. This stand is of course opposed to the acceptance of a universal law of attraction, and discounts the Cavendish experiments. The objections of several British scientists to the new theory are rather ingeniously met, but in its present stage the theory is at best but an interesting speculation.

THE GERMAN TERROR IN FRANCE. By Arnold J. Toynbee, Late Fellow of Balliol College, Oxford. New York: Hodder & Stoughton, 1917. 8vo.; 228 pp.; with maps and illustrations. Price, $1.00.

Following the trail of the German hosts from Liège to the Marne, between Namur and Verdun, as they flowed into Lorraine, and pressed from Malines to the Yser, this narrative of horror marshals the evidence of civilians, victims and soldiers, and even of the Germans themselves, with no attempt at word-painting or sensationalism, but with a cumulative effect that must key the soul of any decent men to passionate resentment. Most of the charges are well-supported by authoritative citations; they are not safe reading for a morbid mind, but it is well that every American should read them at least once, that he may be steeled to higher effort by an enhanced knowledge of the justice of our cause.

THE MYSTERY OF MATTER AND ENERGY. By Albert C. Crehore, Ph.D. New York: D. Van Nostrand Company, 1917. 12mo.; 173 pp.; illustrated. Price, $1 net.

The results of recent scientific investigation are here briefly set forth with two aims in view; the first, to show toward what goal all these earnest and painstaking studies are pressing; the second, to create, through wider sympathy and understanding, a more general enthusiasm for science. This the writer holds to be essential for moral as well as for material progress. He has avoided mathematical language, yet manages to give the essential facts of the establishment of the atomic constitution of matter, the discovery of the electron and the measurement of its charge, the electromagnetic theory, the nature of the X-ray, and the formation of molecules from atoms; illustrations show models of crystals and folding charts show the beautiful geometrical designs which the fields surrounding an atom form. The work constitutes an attractive little exposition in readable style.

THE HOTEL BUTCHER, GARDEN MANAGER AND CARVER. By Frank Rivers. Chicago: The Hotel Monthly Press. 8vo; 202 pp.; illustrated. Price, $2.

THE BOOK OF SAUCES. By C. Herman Senn. Chicago: The Hotel Mothly Press. 130 pp. Price, $1.

Out of the fullness of his life's experience, Mr. Rivers speaks of meats and the service of meat foods, with particular reference to the hotel, the restaurant and the club; the chef, he says, should be a master of the arts of butchering and carving; too frequently he is nothing of the sort. By means of lavish illustration, this work makes plain the fine points of meat-cutting, including the carving of fowl. There are plans and photographs of many of the best hotel kitchens in this country, and information that runs the gamut from the back-bone of an oyster to mechanical refrigeration. The author is generous with many little secrets that mean saving in time and money and improvement in service. "The ook of Sauces" claims to be the largest and most complete collection extant. The importance of this branch of cookery, adjunct as it is to all dishes from savory to sweet, may not be disputed; here, beside the standard compositions, may be found compounds and auxiliaries original with the author. The work is in a small, handy form, well-indexed, and provided with blank pages for additional recipes.

APPLIED MOTION STUDY. By Frank B. Gilbreth, Consulting Management Engineer, and L. M. Gilbreth, Ph.D. New York: Sturgis & Walton Company 1917. 8vo.; 238 pp.; illustrated. Price, $1.50 net.

There are two objections made by the doubting Thomases to "scientific management:" that it increases fatigue, that it increases monotony. As to fatigue, the very first step toward modernizing plant practice is to eliminate all unnecessary fatigue by supplying chairs and rests and by adjustments of the working equipment. As to monotony, a subtile manifestation of deadly dullness that is not necessarily an accompaniment of standardized and repeated operations, the authors believe that this condition can be avoided by making the work itself interesting, and by making the results of the work interesting, so that the mind dwells on the results while the work is being done. The papers sketch the relation of scientific management to America's position in industry, explain the units, methods, and devices of measurement and the opportunity these unfold, describe and illustrate the instruments of precision used in motion and time study and in the measure of achievement, show the part played by the motion model in the transference of experience and the presentation of comparative results in educational methods, and advance motion study as a friend of the crippled soldier. Those familiar with earlier works by the same authors will not be disappointed in this later contribution.

METER RATES FOR WATER WORKS. By Allen Hazen, S.D. New York: John Wiley and Sons, Inc., 1918. 8vo.; 223 pp.; with diagrams. Price, $2.25 net.

More water is wasted than is used; this condition is a matter of grave concern to those who supply the water, but in the end it affects also the consumer. The burden of supporting a water-works system is almost never distributed justly and equitably among the consumers; and here, while the users are first concerned, the condition reacts upon the supply company. As a civil engineer and a very active member of water-works associations, the author of this treatise has had the best of opportunities for familiarizing himself with the problems presented, and his findings should be known to all interested persons. The treatise establishes the fact that the meter system is the only practical method for lessening waste and equitably adjusting rates; actual conditions in various centers of population are shown diagrammatically. Meters, leakage, cost classification, and equitable rating are exhaustively dealt with; the suggestions are the outgrowth of experience and first-hand knowledge, and offer methods and aids worthy of serious consideration.

THE NATURAL STYLE IN LANDSCAPE GARDENING. By Frank A. Waugh. Boston: Richard G. Badger, 1917. 8vo.; 151 pp.; illustrated. Price, $2.50 net.

OUTDOOR THEATERS. The Design, Construction and Use of Open-Air Auditoriums. By Frank A. Waugh. Boston: Richard G. Badger, 1917. 8vo.; 151 pp.; illustrated. Price, $2.50 net.

These opportune volumes of Professor Waugh are both unusual and unusually good, and the publisher has risen to the occasion and given the works a format that is a credit to his own art. Since the author is head of the Horticultural Department at Amherst Agricultural College, and was recently appointed as consulting landscape architect to the United States forest service, it follows that anything he may say of landscape gardening is well worthy of attention; it does not necessarily follow, however, that his opinions and experience should be expressed in the charming manner that delights us as we turn his attractive pages. His attractive style doubles the value of what he has to say, and even the man who is not especially interested in the subject will read his

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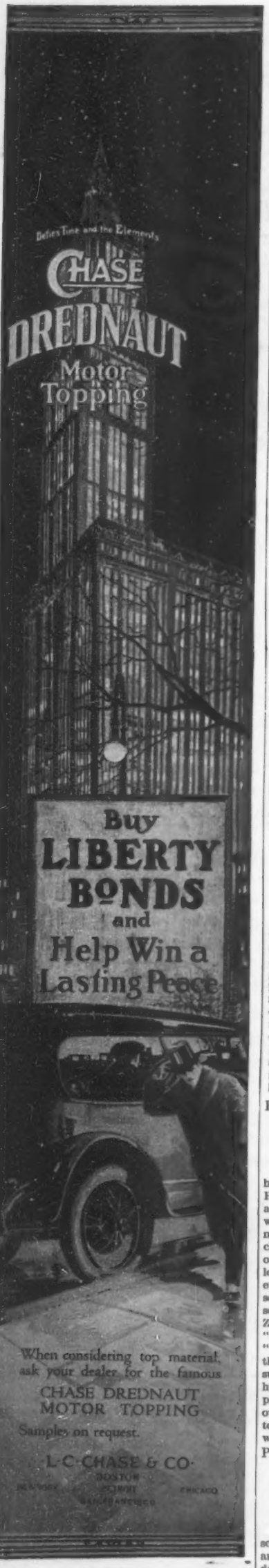

papers on the native landscape, form and spirit, the motive, the principles of structural composition, and the art of grouping, with eager pleasure. The author offers us a "clear-cut, workable outline of the technique of design;" he would conserve and develop the native landscape and make it accessible and intelligible to all. His companion volume, "Outdoor Theaters," has an introduction by Percy Makaye that strikes the keynote of the work, successfully defends the natural setting for certain forms of dramatic art, and urges the use of public parks and commons for this purpose, to the enhancement of the people's civic pleasure. The plates, sketches and plans show existing outdoor theaters, and Professor Waugh's happy exposition of the problems of design and use goes to the heart of the matter.

SAVING AND INVESTING MONEY. By Thomas E. Sanders, Racine, Wis.: The Thrift Publishers, 1917. 12mo., 201 pp. Price, $1.

Thrift is the one great need of our nation in its present great extremity; if we are to win this war, thrift must become the daily habit of the majority of our citizens. The writer of these ten brief lessons tells exactly how to acquire this habit, how to own your own home, and how to invest your spare money without taking undue risks. With hundreds of new mining and industrial schemes seeking capital through the mails, the small investor should understand that he is taking a 16 to 1 chance when he yields to the promoter's persuasion. An enormously high death rate prevails even among such schemes as are honestly conceived and diligently pursued, and Mr. Sanders' instruction and warnings should save many a man from losing his savings. He will learn a great deal of the comparative advantages and disadvantages of real estate mortgages, industrial stocks and bonds, municipal and public-utility bonds, railroad mortgages, and life insurance, and will be much better equipped to meet the problems of life and to emerge a victor.

THE FRENCH "75." THE GUN, ITS FIRE, ITS PROJECTILES. By M. Th. Schoesing, Jr. Translated from the French by Lieut. Frank H. Canaday, Menasha, Wis.: George Banta Publishing Company, 1918. 32 pp.; illustrated.

We have all heard of the famous "75" and the sterling service it has rendered, but probably few of us could enumerate its salient features. This little treatise shows the evolution of the piece from the "90 gun" of 20 years ago; there are diagrams of the recoil brake mechanism, the carriage trail, and the cradle and sight; the advantages of the sliding shift and the independent sight are demonstrated and the operations of aiming for elevation and direction are described; the piece is adapted to fire either shrapnel or high explosive shell, and these projectiles are illustrated in detail; the "75" is compared with the German "77" and the general inferiority of the latter is made plain.

ANALYTICAL AND CRITICAL BIBLIOGRAPHY OF THE TRIBES OF TIERRA DEL FUEGO AND ADJACENT TERRITORY. By John M. Cooper, Washington, D. C.: Government Printing Office, 1917. 8vo.; 243 pp.; with folding map.

The author has made an intensive study of these tribes, and now gives us a working guide to the anthropological sources; the volume collects, analyzes and evaluates existing publications presents full lists of references covering various phases of anthropology, and sifts the available material for any evidence that may go toward clearing up obscure or debated points. The introduction gives the general divisions of tribes, carries a comparative glossary, and reviews the history of investigation. Bibliographies of authors and subjects follow, in which a wealth of material is revealed that includes environment, somatology, languages, culture, archeology and relations.

PAUL JONES. His exploits in English Seas during 1778-1780. By Don C. Seitz. New York: E. P. Dutton and Company, 1917. 8vo.; 327 pp.; with frontispiece. Price, $3.50 net.

The lengthy bibliography comprising the latter half of this work is sufficient evidence that John Paul Jones has had fully his share of historical attention; yet in this latest tribute to his fame we get an entirely new point of view; for it is made up from British newspaper-clippings that chronicle Jones' activities at the time of their occurence, thus making what has become almost legendary a real and human record of actual events. The extraordinary fright into which the seacoast towns were thrown by the "Ranger" seems to surpass anything we have heard of the Zeppelin raids; there are thrilling accounts of the "Bonhomme" squadron, of the taking of the "Serapis," and of Jones' adventures after leaving the "Texel." His discipline is shown in his summary way of dealing with deserters; his humanity by his generous attitude toward the pilot who lost an arm in his service. Bits of his own forceful writing appear also, and his courtesy toward those he defeated is in marked contrast with the Teutonic barbarities of today.

PRACTICAL CONCRETE WORK FOR THE SCHOOL AND HOME. By H. Colin Campbell, C.E., E.M., and Walter F. Beyer, C.E. Oak Park, Ill.: Published by the Authors, 1917. 8vo.; 164 pp.; illustrated. Price, $1.50.

Intended primarily as a workroom manual for school shop use, this well-written treatise opens an interesting field of study that includes the development of wood-working skill. Concrete as a medium of artistic expression adapted to common use has come into deserved popularity of late years, and this restatement of the principles of good practice combined, as it is, with such wealth of suggestion in the way of designs, accomplishes a commendable purpose in a most satisfactory manner. Step by step the pupil is initiated into the necessary processes for mixing and surface-finishing concrete, for building the forms, and for completing walls, pavements, tanks, posts, and ornamental objects that enduringly beautify home surroundings. Mr. Campbell is Director of the Editorial Bureau of the Portland Cement Association, and Mr. Beyer was formerly assistant engineer with the Isthmian Canal Commission: their knowledge and experience has resulted in the production of a practical and easily understandable text.

FLOTATION. By T. A. Rickard, Editor of the Mining and Scientific Press, and O. C. Ralston, U. S. Bureau of Mines. San Francisco. Mining and Scientific Press, 1917. 8vo.; 416 pp.; illustrated. Price, $3.

This excellent work deals with flotation processes in metallurgy, and with the physical principles upon which these rest; there is a concise historical review of the art, and its principles are made readily understandable by the aid of admirable diagrams and clear description. The past few years have witnessed rapid progress in practical applications, and the greater part of the work is devoted to this recent development; aside from interesting papers of a more general nature there are specific studies such as that of flotation at Calaveras Copper, which carries an illustration of the cell arrangement and a flow-sheet diagram; mechanical development is traced; the process as applied to oxidized ores and gold and copper is sketched, and there are chapters on "tribulations," litigation, and cost data.

THE REBIRTH OF RUSSIA. By Isaac F. Marcosson. New York: John Lane Company, 1917. 12mo.; 224 pp.; illustrated. Price, $1.25 net.

It is hard to read this enthralling narrative without forgetting that it is contemporary history and not a "Prisoner of Zenda" romance. Yet it is the unvarnished truth as related to the writer by such men as Kerensky and Lvoff, supplemented by the writer's own experiences in Petrograd during the earliest days of freedom. The pictures of these crowded days are most dramatic and thrilling. A hunger strike becomes roaring Revolution, the soldiery embrace the popular cause, and the Romanoffs crash down to oblivion like an ancient tree in the path of the lightning. There are revelations of Russian character that hold out encouragement even in these black hours of despair. The chief lesson seems to be that only unselfish cooperation between capital and labor, conservative and radical, can produce stable and enduring national prosperity. Mr. Marcosson's work has been styled an epic; greatly abused as this term has been, it is in this case justified; there is a poetic vitality here that makes for entrancing reading and reminds one of Kipling's earlier work; it is journalism at its best.

D'ORCY'S AIRSHIP MANUAL. An International Register of Airships with a Compendium of the Airship's Elementary Mechanics. Compiled and edited by Ladislas D'Orcy, M.S.A.E. New York: The Century Co., 1917. 8vo.; 232 pp.; illustrated. Price, $4.

Perhaps the most valuable feature of this manual is the large body of information dealing with the airships built by Germany since the beginning of the war; this includes illustrations of the various types, specifications of length, beam, volume, power and speed, and notes relating to the history and achievements of individual craft. Similar illustrations and tabulations are given for other nations, but of course recent constructions of the Allies are unavailable for military reasons. World production is given, nation by nation, by volume in cubic meters, through the year 1916, and there are lists of the military airship fleets giving their strength and composition at the opening of the war. Losses, both of the Allies and of Germany, are tabulated as completely as possible, and the section treating of German air raids on Great Britain gives dates, places and casualties. The commercial fleets of 1914 and the world's airship sheds form other sections that round out and complete a most valuable compilation of facts and statistics, toward which many widely scattered and many hitherto untranslated articles have contributed their information.

THE HIGH COST OF LIVING. By Frederic C. Howe, Ph.D., LL.D., Commissioner of Immigration at the Port of New York. New York: Charles Scribner's Sons. 8vo.; 285 pp. Price, $1.50 net.

The author is well known to a certain section of the reading public as a writer both sociological and logical. His latest work sharply defines the issue in three words—people vs. privilege, and it places before the reader, without fear or favor, a condition that is fast hurrying the nation to a crisis. Already, says the author, it has come to the strangling of our boasted freedom and the semi-starvation of the poor. From the above it will be seen that the situation is handled without gloves, and, whether we altogether agree with the writer as to causes and remedies or not, his book demonstrates, if such demonstration be necessary, that we are facing a condition and not a theory. He is correct in saying that while banking, transportation and industry are organized and integrated the most important financial, transportational, industrial and sociological undertaking of the age—the feeding of the people—is left to selfishness and to chance, and it is these factors that determine the amount of food production, the wages of the producer, and the price to the ultimate consumer. There are illuminating chapters on the farmer and his problems, on middlemen and distributors, on cold storage and food speculation, and on food control in Germany.

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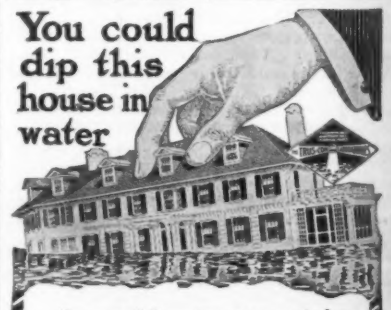

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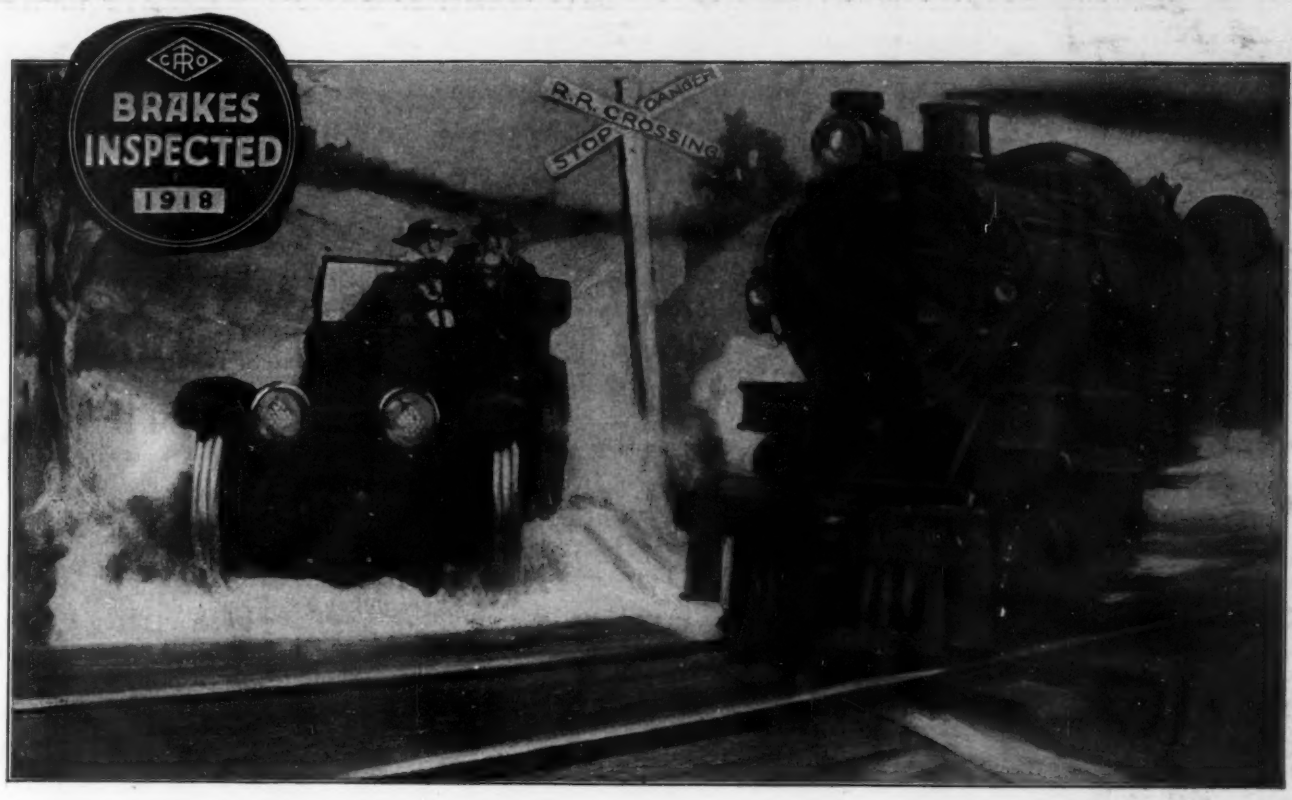

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Don't wait for an emergency to test your brakes

WHEN the unexpected happens, can you count absolutely on your brakes? At the moment they are most needed will they act quickly, surely and safely?

They are out of sight and for that reason are frequently not given the attention which they demand. Yet on their efficiency depends your enjoyment and safety.

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The engineers of fifty-one leading manufacturers, ten axle makers, and countless jobbers and dealers have selected Thermoid Brake Lining because they know its dependability.

1. More material, greater service—There is over 40% more material and 60% more labor used in the manufacture of Thermoid Brake Lining than in any woven brake lining. This abundance of material and labor must mean longer wear.

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The measure of Thermoid value

These three exclusive features form the measure of Thermoid value to the motorist—his assurance of longest, safest service at the lowest possible price.

Have your dealer inspect your brakes today. He will show you Thermoid Brake Lining that you may see why it is so different, so efficient, and long wearing. If he hasn't Thermoid we will gladly send a sample.

Be sure to accept no substitute, our guarantee protects you. ***Thermoid will make good or—WE WILL.*** It is positively guaranteed to outwear and give more satisfactory service than any other brake lining.

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Brake Inspection Movement

Prominent officials, leading clubs and organizations and motorists everywhere have endorsed this big national movement to reduce automobile accidents, by having all brakes inspected before the touring season begins, and regularly thereafter. Give it your support.

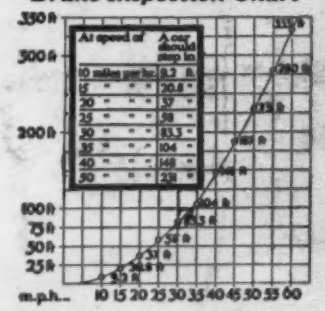
$\frac{V^2}{10.8}$ **Will your car do this?**

Automobile engineers have proved that when brake mechanism is right and road conditions average, any car should stop at distances and speeds given by the chart.

V^2 means the square of the velocity or speed of your car; 10.8 is the proved factor of retardation under average road conditions. This factor decreases on smooth, slippery roads to 6.7 and increases as high as 17.4 on rough, worn roads. The chart represents the average condition and other conditions can readily be figured by changing the factor within the given limits.

Remember that your brake mechanism is not "right" unless its brake lining has the ideal coefficient of friction. The better the brake lining the quicker your stop.

Thermoid Brake Inspection Chart



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Thermoid HYDRAULIC COMPRESSED 100% BRAKE LINING

Thermoid GRAPNALIZED WONT GRAB OR SLIP

Makers of "Thermoid Crolide Compound Casings" and "Thermoid Garden Hose"

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THE noticeable preference for FATIMAS in the Army and Navy is, of course, accounted for by the very same thing that makes FATIMAS so widely popular in everyday life.

That thing is, that in addition to their pleasing taste, FATIMAS offer an *extra advantage*—true smoking *comfort*, while they are being smoked and afterwards, too.

So that, even if occasionally a man does smoke more often than usual, FATIMAS never unpleasantly remind him that he has smoked too much.

That, indeed, is true smoking *comfort;* it is common sense applied to cigarettes; it is the reason why FATIMAS are known as a sensible cigarette.

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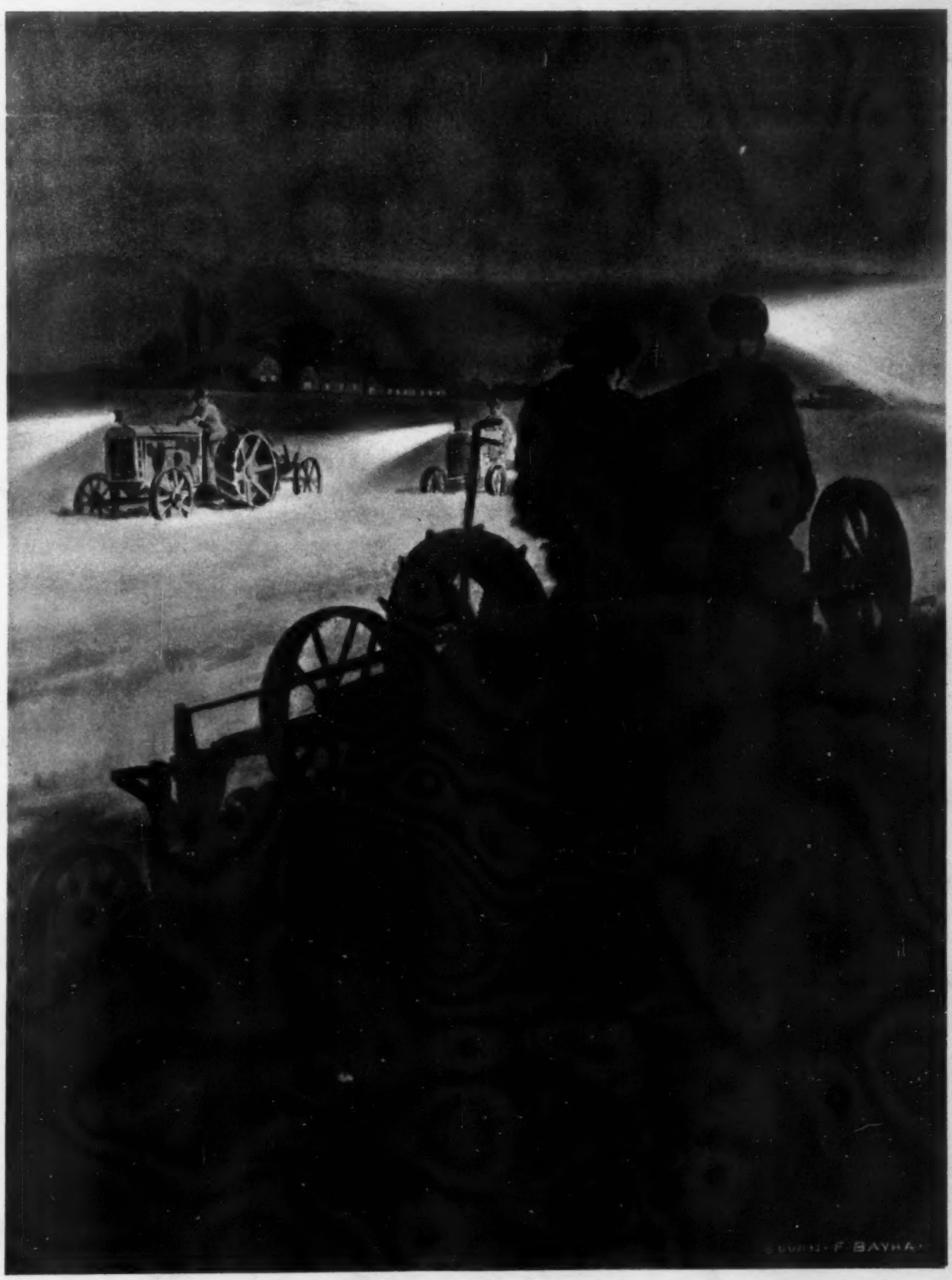
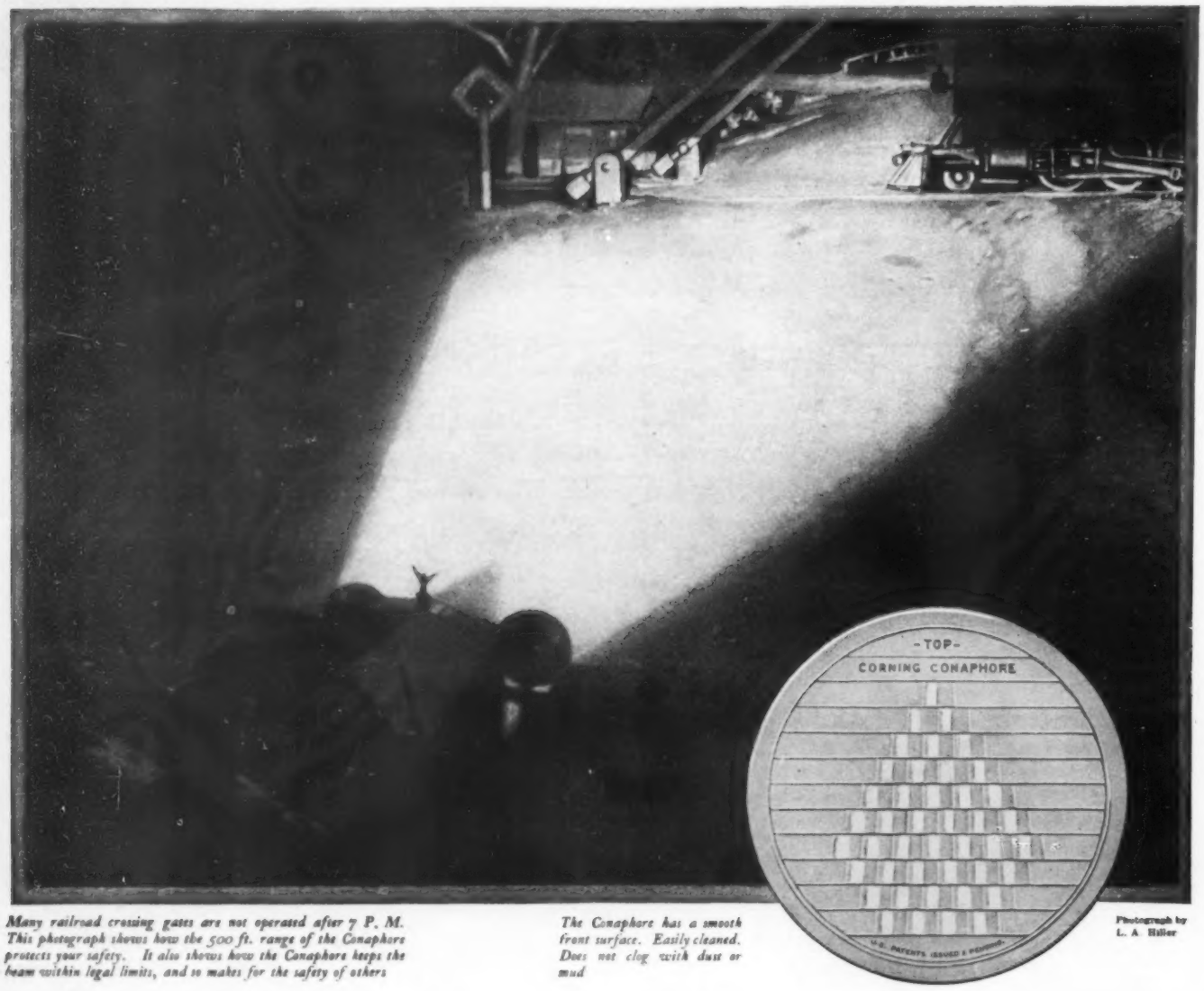


ENGLISH WOMEN PLOWING AT NIGHT BY ELECTRIC LIGHT WITH AMERICAN TRACTORS [See page 341]

April 13, 1918

Munn & Co., Inc., Publishers
New York, N. Y.

Price 10 Cents



Many railroad crossing gates are not operated after 7 P. M. This photograph shows how the 500 ft. range of the Conaphore protects your safety. It also shows how the Conaphore keeps the beam within legal limits, and so makes for the safety of others

The Conaphore has a smooth front surface. Easily cleaned. Does not clog with dust or mud

Photograph by L. A. Hiller

Lights every inch of the road for 500 feet

How the Conaphore produces maximum range, yet kills all glare

SAFE night driving requires all the range your headlights can produce.

Yet the safety of others demands elimination of glare.

Conaphores fulfill both these requirements.

The Conaphore does not diffuse and scatter the light in all directions. Neither does it dump the light directly in front of the car. Instead, Conaphore design directs all the light where it is most effective, and shoots a long, broad beam ahead for 500 feet and more.

Design that produces efficiency

A series of patented corrugations on the inner surface of the Conaphore bend down the beam, while cylinders in the center fan ample light sidewise.

These corrugations also limit the height of the beam to 42 inches. There is no chance of blinding the other fellow, and you are within the requirements of any state or local headlight law.

Eliminates "back-glare"

The Conaphore is the only headlight glass that shoots a beam of light through fog or dust without "back-glare." This is because it is made of Noviol Glass (*patented*)—a unique, yellow-tint glass invented by Conaphore designers and used in no other headlight device.

Blue and violet rays present in all white light are the chief cause of "back-glare" because they are easily diffused by fog or dust particles. Noviol Glass absorbs these blue and violet rays, but projects all the rest of the light. Thus the Conaphore eliminates "back-glare," and gives you perfect road vision, even when the night is thick. *The Noviol beam makes the easiest light for your eye to follow.*

Conaphores are made in clear glass for those who prefer, but we strongly recommend the Noviol.

Help fight the glare menace

Put Conaphores on your car at once, and do your share to stamp out the glaring headlight evil. Conaphores kill glare, yet they give you the long range you need for safe, comfortable night motoring.

Easy to install. Sizes made to fit all cars. If your dealer has not yet received his stock, write us and we will see that you are promptly supplied.

PRICE

Noviol Glass	Per Pair	Clear Glass	Per Pair
5 to 6⅞ inches incl.	$2.40	5 to 6⅞ inches incl.	$1.60
7 to 8⅛ inches incl.	3.50	7 to 8⅛ inches incl.	2.50
8⅜ to 10 inches incl.	4.50	8⅜ to 10 inches incl.	3.00
10⅜ to 11⅛ inches incl.	6.00	10⅜ to 11⅛ inches incl.	4.00

Sizes vary by steps of ⅛ inch above 6⅛ inch size
Prices 25c more per pair west of Rocky Mountains

Manufactured by the World's Largest Makers of Technical Glass

CONAPHORE

Range 500—No glare—Pierces fog and dust

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